OCTOBER 12, 1935

ELECTRICAL WORLD

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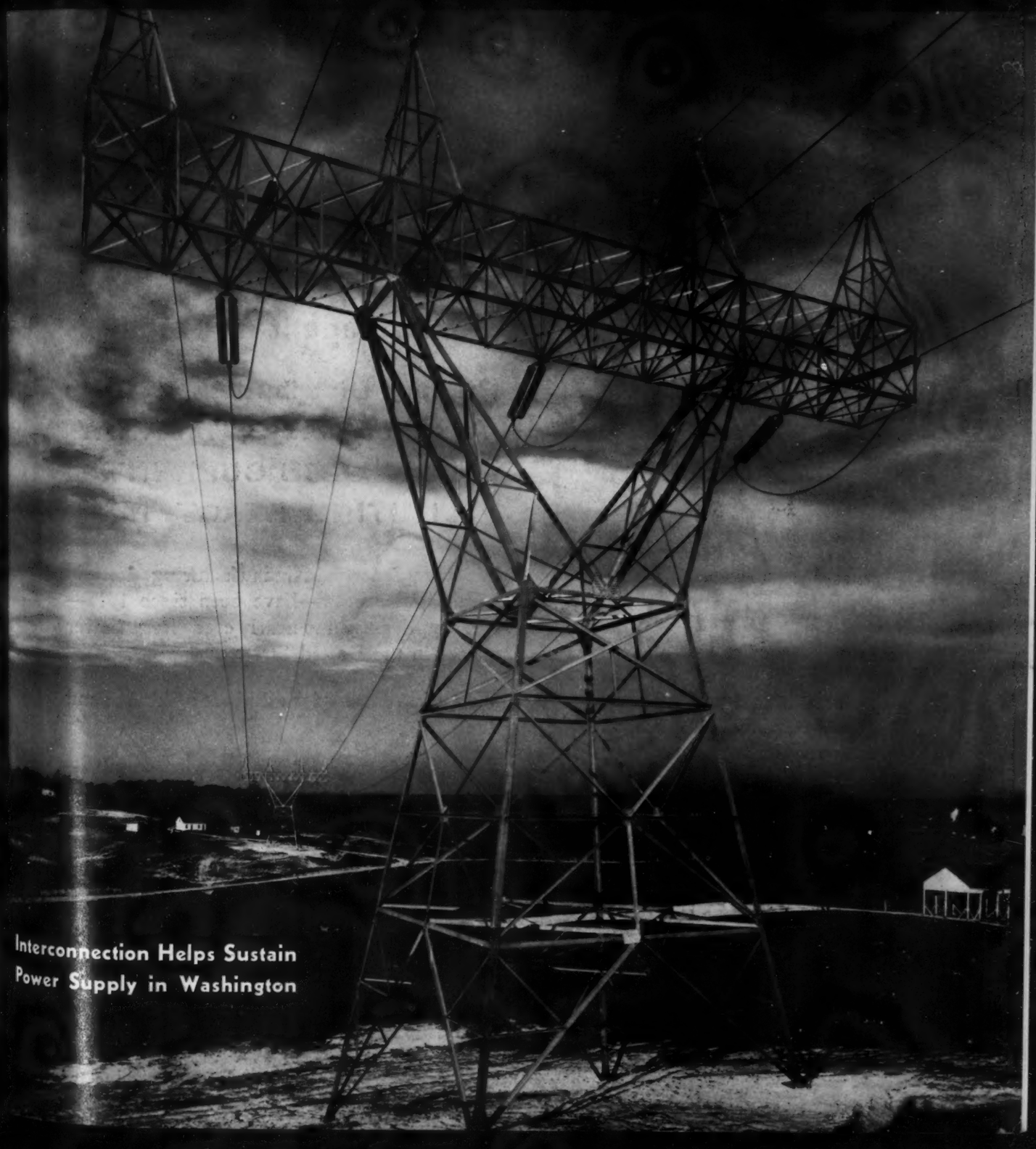

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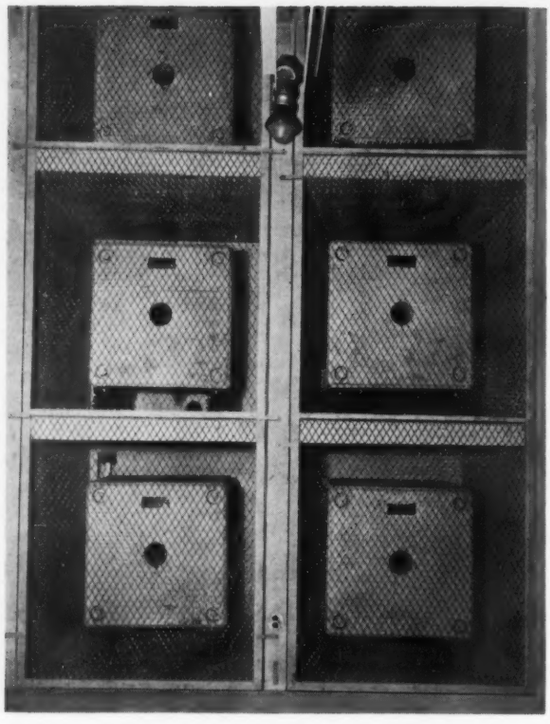

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ELECTRICAL WORLD

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Reader's Guide to This Issue

This index is merely a convenient guide. Many articles will appeal to several reader groups—many will apply to all. News and other departments are of general interest.

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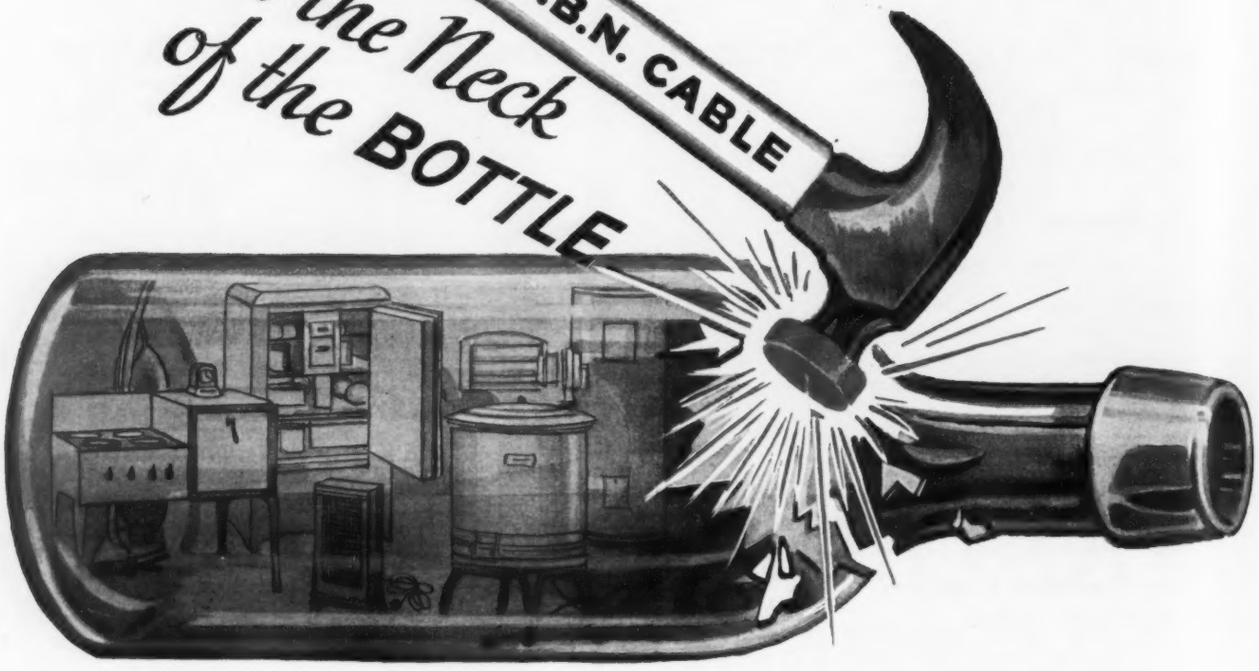
Breaks the Neck of the BOTTLE



The small sized pipe-enclosed wires of many old type house services definitely limit the customer's connected load.

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OCTOBER 12, 1935

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New Peaks for Electrical Business

THERE is a strength and a soundness in the electrical industry that gives it power to surmount any obstacles that stand in its path. This is the key thought brought out at the meeting of the electrical manufacturers in Chicago this week. They have weathered the NRA, the depths of the depression and the "football plunges" of the New Deal and exhibit a spirit and a confidence in the future that should be inspiring to the other branches of the industry.

In the opinion of President F. C. Jones of N.E.M.A., 1936 will create a new peak in utility output and will start a revival of capital goods purchases by the utilities. Complete recovery for all branches of the industry will occur in 1937, so that by 1938 or 1939 the electrical industry will have the greatest volume of business in its history. This attitude and opinion were reflected by all those in attendance and show the confidence and the courage of the manufacturers in these times of turmoil.

THIS branch of the industry has been hit hardest by the depression. It has undergone the unparalleled experimentation of the Administration and has co-operated fully in the planned economy and social security endeavors of the New Deal. Manufacturing executives did this while recording deficits instead of profits and while many of them could barely keep the wolf from the door. When the NRA was squashed they cheerfully went on to other measures, and their unflagging co-operative spirit under the conditions earns them an outstanding place in the record of American industry.

Today they see prosperity in the offing. Their business has increased somewhat. They have stabilized trade practices and avoided destructive price competition. They will work out new plans on trade agreements with the Federal Trade Commission. They will go after business in the belief that it can be had and that they can prosper. They have seen the political harassment of their best customers, the utilities, but they believe this persecution will be ineffective and has an offsetting effect in that the Administration has unwittingly "sold" the use of electricity to the entire country. These men are business realists, and it is encouraging indeed to find them in full strength and confidence and with the determination to carry on the forward progress that is traditional in the electrical industry.

IN GENERAL the program of the manufacturers is based upon getting back to prosperity levels as quickly as possible. They are going to maintain the good features of NRA by their own acts. They are going to strengthen the co-operative work in research and sales promotion under N.E.M.A. auspices. They stand ready to co-operate with the other branches of the industry in developing business and in improving the status of the industry in all aspects. They stand fully pledged to the virtue of private enterprise conducting the business of this country. They believe in the natural ebb and flow of goods and services at prices which are determined by the volume of business and by costs rather than those fixed by artificial barriers or agreements.

This meeting of N.E.M.A. was inspiring to those in attendance and exhibits the attitude that should prevail in all branches of the industry. Business is on the up-grade. Despite maladjustments that create fears for the future, the manufacturers are determined to go ahead, to promote their business and to help bring back recovery. They are wagering their money and their man-power on a prosperous future.

ELECTRIFIED DREDGE PUMPS RIVER SILT FOR GOLD

Gone are the husky clutches and brake levers. In their place control handles and buttons for fingertip accessibility. Steel mill control for the monster which carries its pond with it as it sifts the bottom for the gold. (See page 24 for electrical details.)

Secondary System Economy

Service and Costs Force Limits—Method of General Economic Analysis Adapted—Choice of Wire Size, Spacing, Transformer Size Capable of Definite Determination

This study points out the relative importance of the investment in secondary distribution and the appreciable savings which can be made by designing it for maximum economy. Adoption of a standard of No. 2 secondaries with a standard spacing of 600 to 800 ft., has been shown as justified for this system. Economy may also lie in the smaller sizes of conductors and medium-sized transformers spaced to give good voltage conditions. This article on distribution is presented under the auspices of the E.E.I. subcommittee on cost of distribution, of which the author is a member.

By **HOWARD P. SEELYE**
Detroit Edison Company

INVESTMENT in distribution transformers and secondaries which serve residential and small commercial customers is a very appreciable portion of the total investment in a distribution system. The money which can be wasted by careless or insufficient consideration of the design of this part of the system is not often recognized. The problem may seem simple, yet it can be shown that there are many thousands of dollars difference on a system of fair size between an economical design and one which may merely give satisfactory service. The investment may well be of the order of $500 or more per 1,000 ft. of line, exclusive of poles, even for relatively light loads, and an excess of $100 per 1,000 ft. above this is not at all difficult to realize, if insufficient study is given to the problem. On a large city system this difference may represent an excess investment of $1,000,000 or more chargeable to the lack of proper engineering.

A mistaken idea, frequently encountered, is that an economical secondary should have large conductors and relatively large transformers, spaced well apart. This is probably predicated on the fact that the cost of transformer capacity per kva. goes down as the size of units goes up. The fallacy of this is not hard to show, however. A little study indicates that, for a distributed load such as that which is being considered, if the transformer spacing is increased, the size of conductor must be increased as the square of the spacing, in order to obtain the same voltage regulation. Since the total transformer capacity must remain approximately the same regardless of spacing, provided spacings large enough to obtain satisfactory diversity between customers are used, the only saving obtained by the wider spacing is the decrease in transformer cost per kva. This saving does not compensate for the increased cost of conductors beyond very moderate sizes, except at very heavy loadings. In general, it has been found that, for ordinary residential service, sizes such as No. 4 or No. 2 wire give satisfactory results, while those as large as No. 00 to No. 0000 are rarely justified, except for occasional "spot" loads of considerable size or where there are local limitations on transformer locations or arrangement.

The material given in this article is the result of a rather extensive study of the design of secondaries as applied to the Detroit Edison Company's system. Costs and service standards used were those pertaining to that system and this should be considered in attempting to apply the results elsewhere. For this reason specific cost figures are omitted and only relative values shown. The principles and methods developed, however, are generally applicable and similar studies for other localities will no doubt give comparable results.

The basic principle which should

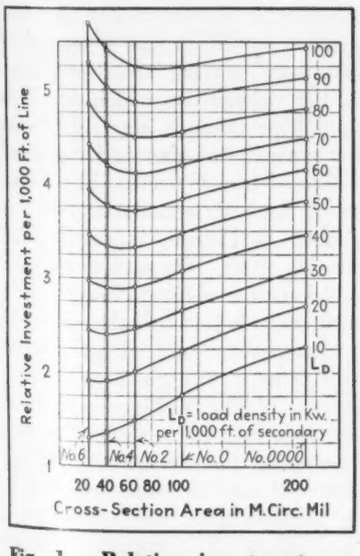


Fig. 1 — Relative investment per 1,000 ft. of secondary with wire at 10 cents per pound
Losses are included.

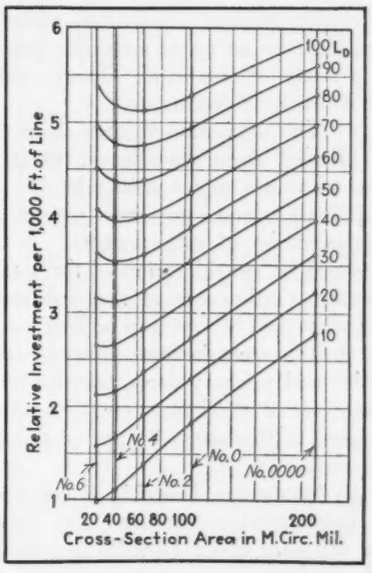


Fig. 2 — Relative investment per 1,000 ft. of secondary with wire at 20 cents per pound

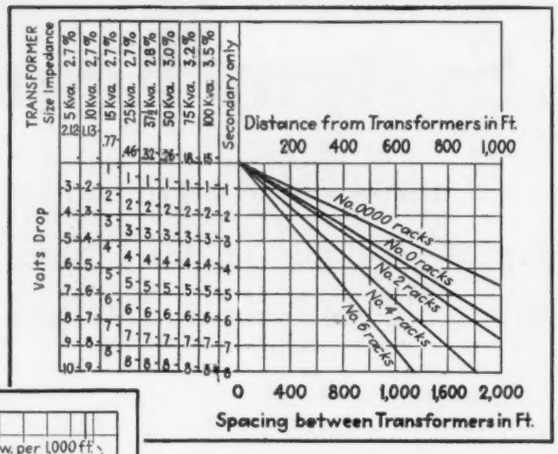


Fig. 3 — Flicker chart, voltage drop with 20 amp. at 115 volts and 50 per cent power factor

Use scale corresponding to transformer used for transformers not in bank. This chart may be used for banked transformers by dividing scale readings at voltage drop by 2, if motor is midway between transformers.

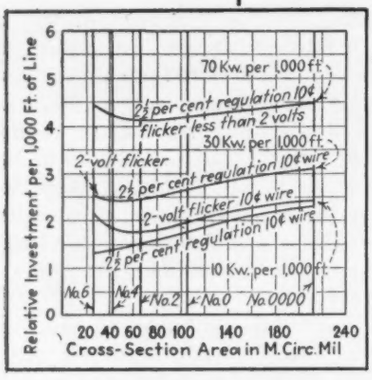

Relative Investment per 1,000 Ft. of Line
70 Kw. per 1,000 ft.
2½ per cent regulation 10¢
Flicker less than 2 volts
30 Kw. per 1,000 ft.
2-volt flicker
2½ per cent regulation 10¢ wire
2-volt flicker 10¢ wire
2½ per cent regulation 10¢ wire
10 Kw. per 1,000 ft.
No. 6
No. 4
No. 2
No. 0
No. 0000
20 40 60 80 100 140 180 240
Cross-Section Area in M. Circ. Mil

Fig. 4—Variation in secondary distribution investment with allowable flicker

Shows effects of limiting voltage dips to 2 volts with transformers banked or 4 volts with unbanked transformers. Assumptions: 115-volt motor starting current 20 amp. at 50 per cent power factor; voltage dip computed to customer's service pole; wire price 10 cents per pound, effect of other prices is similar.

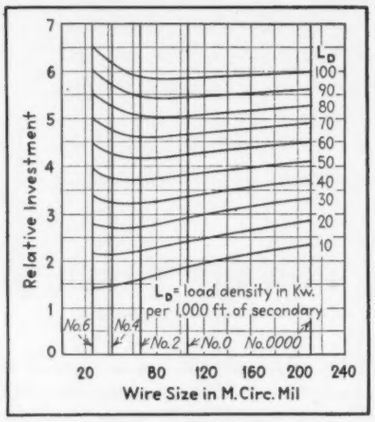


Fig. 5 — Relative investment per 1,000 ft. of line with transformer loaded to 75 per cent of rating and wire at 10 cents per pound

underlie all distribution design is that it should be such as to give "the least possible cost consistent with good service." Ideas differ as to what is good service, but some standards as to allowable voltage regulation, flicker, etc., must be set up as a starting point in a study of this kind. In general, the controlling factors are:

(a) The maximum voltage drop to be allowed from transformer to farthest customer under steady load. It is difficult to make any exact economic determination of this quantity. It is obtained by consideration of the total regulation allowable at the customer and what part of that may be best used up in the secondaries, allowing for feeder and primary drop, transformer drop, use of regulators, etc. For the purpose of this study 2½ per cent was assumed.

(b) Maximum allowable flicker due to motor-starting currents. Any voltage dip over about 1½ volts is noticeable under some circumstances, and whatever larger limit is set must be determined arbitrarily, with regard to the type of customer, whether or not he himself causes the disturbance, the frequency of occurrence and time of day. In the charts given here a dip of 2 volts at the service was assumed for banked secondaries, or 4 volts for those not banked, caused by a 20-amp. starting current at low power factor.

(c) Voltage drop due to relatively large concentrated loads such as electric ranges. On the Detroit system a limit of 6 volts drop on test with the range on full has been found satisfactory, since such a condition of operation rarely occurs.

The design of the system should be such that the limiting conditions of good service which are established shall be satisfied and that the cost shall be a minimum over a long period of time with increasing load.

In this study the criterion used for comparison was the total investment in transformers and secondaries (not including poles) per 1,000 ft. of line, including capitalized losses. Uniformly distributed load was assumed and a range of load densities (L_D = kw. per 1,000 ft. of line) and wire prices were included. Continuous secondary, which is a practicable condition in Detroit, was assumed, with transformers spaced as desired along it.

The comparison between various wire sizes, assuming as a basis wire at 10 cents per pound, is found in Fig. 1. An ideal use of transformers was made; that is, the transformer size and spacing were taken at any odd amount necessary to carry the load with 2½ per cent voltage drop to the farthest customer. Such an assumption is partially justified by considering this as an average condition which would be approximated by standard sizes of transformers at various spacings determined by field conditions. The effect of other prices of wire, underloading of transformers and use of standard sizes of transformers and fixed spacings are shown by other charts. Pertinent points indicated by the curves are:

1. The marked economy of the smaller sizes of wire at low-load densities. No. 4 is considerably less than No. 0 at 20 kw. density, for example. The excessive cost of No. 0000 even at very high densities is apparent.

2. No. 4 is an economical size up to 30 kw. density. Above that No. 2 is to be preferred up to 90 kva., which is a high value for present conditions.

A similar curve for 20-cent wire is given in Fig. 2. The economy of smaller wire is even more apparent at this price, which is, of course, high for present conditions. The values for any intermediate price between 10 and 20 can easily be interpolated.

A chart is shown in Fig. 3 which gives, for any given size of secondary, transformer spacing and transformer size, the voltage dip which would be caused by a 20-amp. starting current, using normal impedances for a standard line of transformers. The advantage of banked secondaries, such as are used in Detroit, is very evident from this chart. On such secondaries the flicker at a point midway between transformers is just half that shown by the chart, since half of the current would come from each transformer.

By use of Fig. 3, Fig. 4 was developed from Fig. 1. It shows the effect of changing the design so that the flicker will not be more than 4 volts with transformers not banked or 2 volts banked. The important feature is the change in the shape and location of the curves for low densities. At a density of 10 kw. a larger size is now

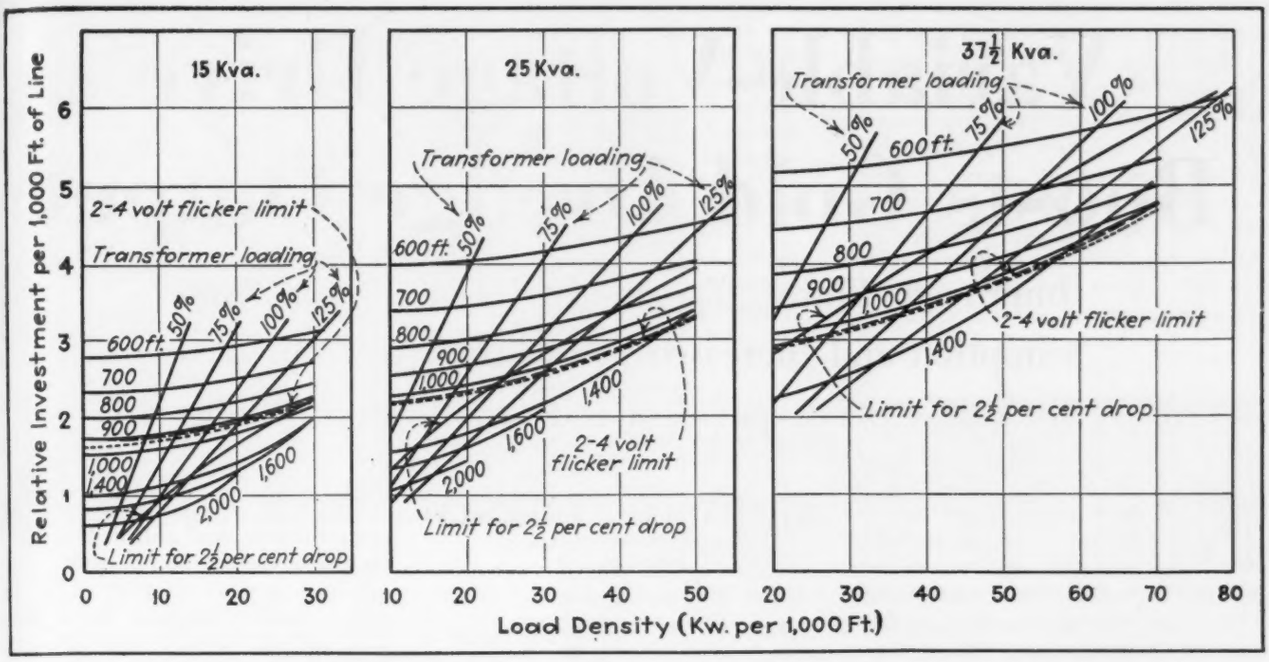


Fig. 6—Relative investment per 1,000 ft. of No. 2 wire, any size, any loading and any spacing

more economical than the No. 6 indicated by Fig. 1. Above 30 kw. normal voltage drop controls transformer spacing and there is no change in the curves. The effect with a copper price higher than 10 cents would be similar (compare Fig. 2).

The effect of underloading transformers is shown in Fig. 5, 75 per cent average loading being used. This is perhaps a more practical basis than the original, since on most systems, with standard sizes of transformers, it is impracticable to obtain 100 per cent average loading, although it has been obtained on many circuits of a banked system when advantage is taken of overload capacity. The results are similar to those of Fig. 1, excepting that economy lies in somewhat larger sizes of wire. The difference in absolute values should be noted, however. At 20 kw. density and No. 2 wire the investment is approximately 10 per cent higher in Fig. 5 than in Fig. 1. On many systems the transformer loading averages much below 75 per cent and the waste is evident.

The Detroit system serves a large number of electric ranges. Layouts are now made with a view to being able to serve a range anywhere and still hold the voltage within the prescribed limits. Without going into the detailed computations it may be said that No. 2 secondaries and a transformer spacing of about 700 ft. have been found most satisfactory for this purpose.

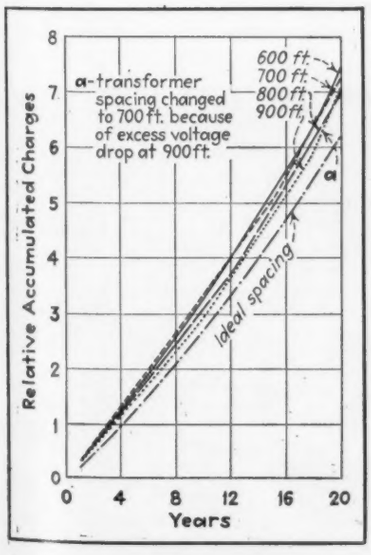


Fig. 7—Accumulated annual charges for No. 2 wire

Load: Increasing from 10 kw. per 1,000 ft. at 10 per cent per year for five years (to 16 kw.), then at 5 per cent per year for fifteen years. *a* = transformer spacing changed to 700 ft. because of excess voltage drop at 900 ft. Fixed transformer spacing.

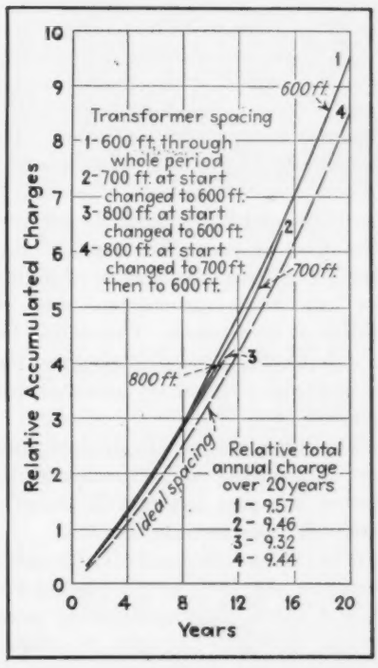

Relative Accumulated Charges
Years
Transformer spacing
1-600 ft. through whole period
2-700 ft. at start changed to 600 ft.
3-800 ft. at start changed to 600 ft.
4-800 ft. at start changed to 700 ft. then to 600 ft.
600 ft.
700 ft.
800 ft.
Ideal spacing
Relative total annual charge over 20 years
1 - 9.57
2 - 9.46
3 - 9.32
4 - 9.44

Fig. 8 — Accumulated annual charges, No. 2 wire, over 20 years

Load: Increasing from 10 kw. per 1,000 ft. at 20 per cent per year for five years (to 25 kw.) then at 7½ per cent per year for fifteen years (to 75 kw).

Choice of wire size

A study of the charts which have been shown and others of similar nature, but with different assumptions, which are included in the investigation of the problem leads to the choice of a standard wire size for secondaries which will be most suitable for all the surrounding conditions. If the restriction on flicker is liberal and no very high load densities are anticipated Figs. 1, 2 and 5 point to No. 4 or even No. 6 as an economical size. If the flicker is to be more closely limited and fairly large load densities may be anticipated No. 2 may be better, especially if the concentrated load is an important factor. Under field condi-

[*Continued on page 66*]

Variable-Voltage Drive Boosts Gold Dredge Output

Improved Power Factor, Reduced Power Consumption and Increased Production Accomplished for 500-Cu.Yd.-per-Hour River-Bottom Dredge

By CHARLES STOECKLY
General Electric Company,
San Francisco

NEW production and cost records for the gold dredging industry are being set by Natoma No. 1,* the latest addition to the dredge fleet of the Natomas Company, operating near Folsom, Calif. Designed by Leland S. Rosener, San Francisco, consulting engineer, the fully electrified boat† embodies many radical departures from established designs.

The basic measure of the effectiveness of a gold dredge is the over-all cost per yard of material handled, so the designer made a direct attack upon both of the controllable aspects of this unit cost, namely, fixed charges per yard and kilowatt-hours per yard. The first of these—the fixed charges per yard—was attacked by designing for maximum production rate per dollar of investment. This called for:

(a) Maximum operating speed consistent with normal or reduced maintenance costs.

(b) Elimination of all lost time; *i.e.*, that during which the bucket line is not bringing up gravel, including time for maneuvering the boat.

The second important element of the unit cost—kilowatt-hours per yard—was attacked by minimizing power losses through the use of efficient electrical and mechanical equipment, and regenerative braking.

Speed, both in operation and maneuvering; continuity of operation and low power consumption were, therefore, the yardsticks by which the desirability of all design features were measured.

Study of the bucket-line drive indicated the desirability of incorporating the following features:

(a) Variable speed to permit best operation in varying formations and depths of overburden.

(b) Gearing of the driving unit to the bucket line, thus eliminating the customary extremely large belt.

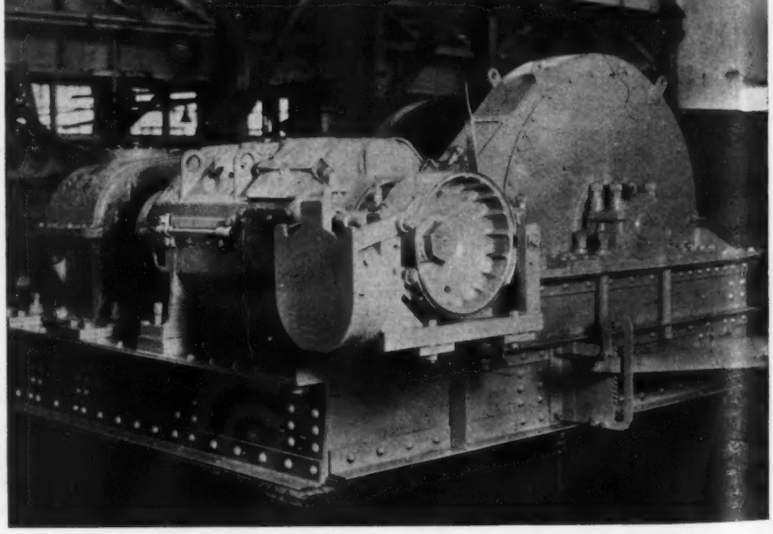
(c) Means for definitely limiting the torque of the driving unit to a value that would prevent mechanical injury should the bucket line be stalled.

The above conditions were fully met by the use of variable-voltage, direct-current motors—one geared to each end of the upper tumbler shaft—supplied with their power by a three-field direct-current generator. It proved to be an ideal selection because (1) it provides the desired wide speed range without the losses that accompany the use of wound rotor motors, (2) there is no problem of load division between the motors, since they are operated in series, and (3) the necessary torque limitation is an inherent and controllable characteristic of the system using the three-field generator and does not depend upon the operation of protective relays.

The drive selected consists of two protected type steel mill motors, rated for the service at 150 hp. each. Each motor is flexibly coupled to an inclosed double reduction herringbone gear set, the output shaft of which drives one end of the upper tumbler shaft through the medium of an intermediate gear set and a cut bull-gear and pinion. The motors and gears are mounted in the superstructure at approximately the level of the upper tumbler shaft.

The generator supplying power to the twin motors of the main drive is the major element of the motor-generator set driven by a synchronous motor.

For an efficient, easily and rapidly manipulated means for swinging at adjustable speed, the dredge is equipped with twin single-drum winches, each of which handles one

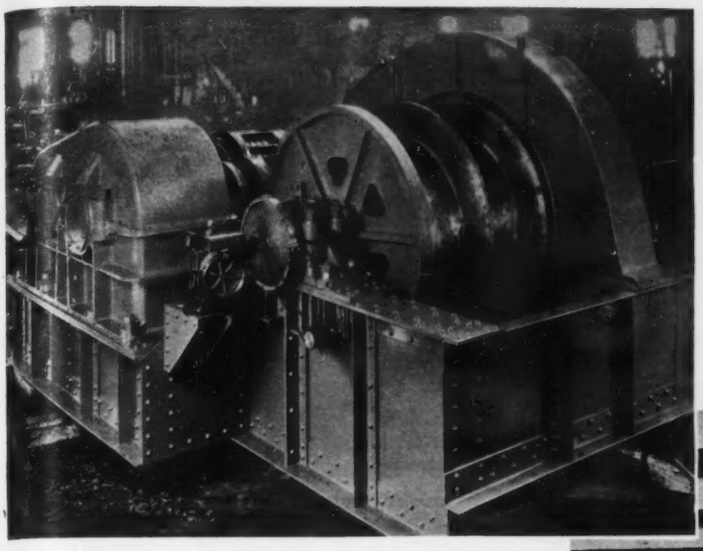


Each bow winch driven through inclosed reduction gears by 75-hp. coupled protected-type steel-mill motor

These two motors take power from individual three-field generators forming a twin unit of the main motor-generator set.

*See frontispiece, page 20.

†For mechanical details see *Engineering and Mining Journal*, June, 1935, pages 270-272.



Lilly hoist controller shuts unit down and applies brake on overspeed or overtravel in either direction

of the bow lines. Here, again, variable-voltage drive was chosen, not only because it provided the necessary wide speed range economically but because:

(a) It automatically returns to the system the power previously wasted in braking the overhauled line.

(b) It automatically holds any selected constant tension in the hauled line without the use of relays or contactors.

(c) It saves much time, in the aggregate, in reversing the direction of swing at the end of the cut.

Ladder hoist drive and stacker

A separate single-drum hoist was provided to raise and lower the tremendous mass of the ladder and bucket line. Here the major objective of the design was safety.

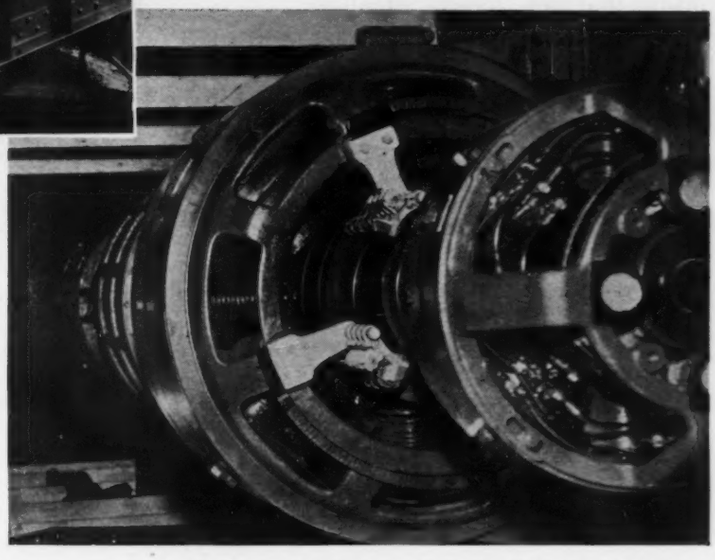
The drum is driven, through suitable inclosed gearing, by a coupled 150-hp., 900-r.p.m., continuous rated three-phase, 60-cycle, 2,200-volt slip-ring motor. The size was selected after a heating analysis of the duty cycle, which involves peak hoisting loads in the neighborhood of 275 hp.

The control for this motor consists of a high-voltage air-break reversing contactor, magnetic secondary panel and master switch. It provides, in addition to a selection of hoisting speeds, regenerative braking lowering, graduated plugging for stopping in the lowering direction and off position setting of the brake.

The brake, which is designed along the lines of a service brake and operates on the drum, is gravity set and is operated by an air cylinder under the control of a standard electric air-brake valve.

The stern winch is a five-drum unit driven by a 75-hp., 900-r.p.m., 2,200-volt, slip-ring motor with reversing magnetic primary and secondary control. Since this winch plays a leading rôle in the maneuvering of the boat, the ease and speed with which it is controlled is of vital importance. Accordingly, each drum is equipped with an electropneumatically controlled clutch and a gravity set air brake. These brakes are fitted with the latest type of self-lapping, air-brake valves to permit holding any desired braking pressure.

Limit switches on the spud hoist and an overspeed switch on the motor operate to shut down the unit and apply the brakes.



Three-field generators in motor-generator set

Power for d.c. motors is derived from a five-unit motor-generator set consisting of a 500-hp., 0.8-power factor, 1,200-r.p.m., three-phase, 60-cycle, 2,200-volt synchronous motor, the three-field generators and a suitable exciter supplying 125-volt power for excitation of the motor field and all the direct-current machinery. Motor proportioned to give unity power-factor operation of dredge as a whole.

ONE-THIRD MORE OUTPUT AT ONE-SIXTH LESS UNIT COST—Dredge Natoma is producing 35 per cent more yards per hour than any other comparable boat in the fleet, at a 15 per cent reduction in kilowatt-hours per yard. Speeds up to 30 buckets per minute are regularly used, maintenance charges are low and maneuvering time has been reduced to a fraction of that formerly required.

The dredge is equipped with two stackers. The conventional drive, consisting usually of a belted slip-ring motor, was abandoned in favor of squirrel-cage motorized speed reducers of weatherproof construction, flexibly coupled direct to the head pulley shaft. Two of these gear-motor units, each rated 30 hp., 440 volts, are used on each stacker, one being coupled to each end of the head shaft. This arrangement has two advantages over the use of a single motor:

(a) The structural problem was simplified as a result of the balanced weight distribution.

(b) As a result of slightly overpowering the drive, either motor alone will handle a stacker under moderate load conditions, thus insuring continuity of operation.

Power is supplied through a shore cable at 2,200 volts from a 900-kva., 60-kv. to 2.3-kv. transformer substation. Provision is made for attaching the cable at either side of the boat.

A most unusual feature of the dredge is the control room in the hull. This space, normally unused, is broken up into a series of compartments by watertight bulkheads, and one of these compartments, on the center line of the boat behind the ladder well, has been used to house all of the control and the main motor-generator set.

The switchgear and control of all motors is incorporated in a dead-front steel-panel switchboard, with hinged panels and plenty of working space both front and rear. The control room is well lighted, neatly arranged and kept clean by being supplied with fil-

[*Continued on page 80*]

One-Cycle Carrier

By PHILIP SPORN . . . C. A. MULLER
American Gas & Electric Company, New York

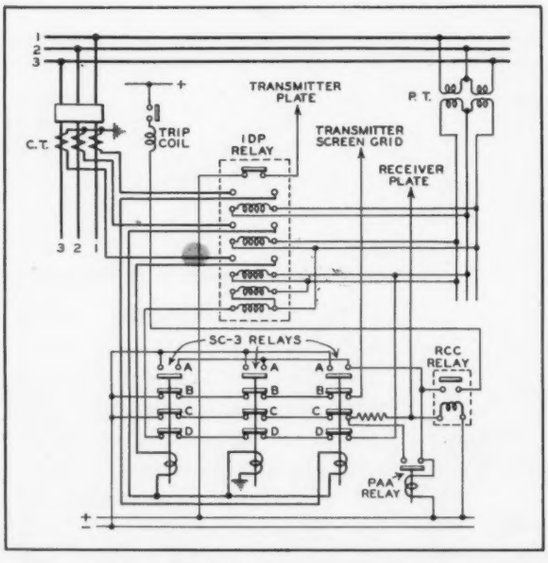
The art of relaying is receiving a new impetus from developments in radio. Carrier currents and vacuum tubes offer some great opportunities to save money and to improve relaying performance. This article is a sample of new development. It should interest all electrical engineers and manufacturers of radio and relay equipment. It is the new and better things that now receive attention.

CARRIER-CURRENT relaying has definitely passed out of the trial period and has now been accepted as an indispensable tool in the hands of the transmission system designer and operator. As such, it has been and is now being, almost daily, applied to furnish complete high-speed protection for transmission lines and systems. A number of steps in the development of a practical system of carrier relaying[1] and extensive operating experience with such relaying[2] have been given in previous articles in the ELECTRICAL WORLD. All the schemes described employ power-directional relays at each station to determine in combination whether the fault is an internal or external fault and to control transmission and reception of carrier current. The speed of actuating of trip circuits of such relay systems has been from 8 to 3 cycles,[3] with a fairly definite limit at the lower of these two values.

Although higher speeds of tripping were always sought, the need for this became particularly acute since a number of important power system developments have taken place that have indicated the necessity of reducing the relay time as close to the theoretical absolute minimum (in power-directional relay practice ½ cycle) as possible. Among these may be mentioned the 3-cycle breaker, such as the impulse breaker, and other breaker developments operating in that order of time. The more thorough studies and investigations of system stability recently carried out have shown[4] material increases in the power limits of combination generator and transmission line systems running to as much as 20 per cent when switching time was decreased from 6 to 3 cycles (in terms of 60 cycles). Again, with the impelling motive of reducing the investment per kilowatt of capacity that is so predominant today, more and more attention is being given to the use of the single-circuit transmission line wherever possible, particularly in cases where the capacity to be transmitted requires no more than a single circuit.

A study of the speed of reclosing necessary to obtain the equivalent of continuous service, even though flashover occurs, has shown that in most cases the equivalent of continuity could be obtained if reclosing can be made within 10 cycles from the initiation of the fault. For such service, if 6 cycles is taken as the waiting time between the extinction of the arc and the time of reclosure so as to prevent restriking of the arc due to incomplete deionization (and a great deal of work that has been done, although incomplete, has indicated that this time lies between 4 and 6 cycles), and figuring the maximum time of clearing the fault as 3 cycles, there is left for the relay, if the 10-cycle limit is to be followed, a maximum of 1 cycle. In this article such an arrangement is outlined; a description of an actual installation and results of tests showing actual performance will be given.

A fundamental diagram of the high-speed arrangement is shown in Fig. 1, which gives an arrangement without ground-directional relays. As will be seen, the outstanding feature is the employment of three simple, multi-contact, instantaneous, overcurrent relays in combination with one three-phase, power-directional relay with voltage



Under normal conditions the IDP directional relay contacts are held closed by voltage restraint applying plate voltage to the transmitter, but the transmitter does not operate due to the normally closed contacts "B" of the SC-3 current relays applying a negative bias to the screen grid of the transmitter. Further, the RCC receiver relay contacts are held open by the closed contacts "C" of the SC-3 relays energizing receiver relay coil from the station battery. In case of an external fault, the instantaneous SC-3 relays operate at both stations to remove voltage restraint from the directional relays, bias from the screen grid of the transmitters and local battery supply from receiver relay coils. The instant that the bias is removed from the screen grids the transmitters at both stations operate, thereby holding receiver relay contacts open. At the station where the power flow is from the bus into the line the directional relay contacts open, stopping the local transmitter from operating, but at the other station the transmitter is operating causing carrier to be received, preventing the receiver relay contacts from closing. After three cycles, the PAA lockout relay contacts at both stations close, to prevent the receiver relay contacts from closing on sudden reversals of power flow after the fault is cleared. Therefore, at both stations the receiver relay contacts remain open, thus preventing tripping of the circuit breakers. In case of an internal fault the operation is similar except that the directional relay contacts will open at both stations, stopping transmission of carrier and causing the receiver relay contacts to close at both stations and trip their respective breakers.

Fig. 1—High-speed carrier current relay circuit

[1] "Carrier Current Proves Its Effectiveness," ELECTRICAL WORLD, September 10, 1932, and "Carrier Current Relaying Simplified," ELECTRICAL WORLD, October 28, 1933.
[2] "Tube Experience in Carrier on Power Systems," ELECTRICAL WORLD, February 2, 1935.
[3] *Electrical Engineering*, January 1935, pages 109-115, and subsequent discussions.
[4] *Electrical Engineering*, November, 1933, pages 758-9.

Relaying Accomplished

Superfast Relaying Makes Possible Maximum Use of Transmission Lines With Single Line Service Continuity as the Attainable Goal

restraint, and one receiver relay. All contacts of the instantaneous overcurrent relay are circuit opening except the tripping contacts, which are circuit closing. This combination gives a circuit having the equivalent of a continuous carrier circuit, with the battery taking the place of carrier under normal conditions; at the same time it eliminates all the disadvantages, such as reduced tube life, interference, etc., of continuous carrier.

The system, moreover, because of the use of a single relay, lends itself to a maximum reduction in the time required for tripping, that time being determined by the sum of the time required to operate the circuit-opening contacts of the power-directional relay, plus the time required to close the contact of the receiver relay; this is based on the assumption that the multi-contact instantaneous relay time is less than the time of opening of the power-directional relay. This has proved no difficulty, as will be brought out later, since such a relay can be made to function at 0.1 cycle. The time for circuit opening of the power-directional relay used in the present arrangement is between 0.4 and 0.5 cycle, and the time of closing of the receiver relay is approximately 0.3 of a cycle, making the fundamental minimum time approximately 0.8 cycle. A more detailed description of the working of the circuit is given in the text accompanying Fig. 1.

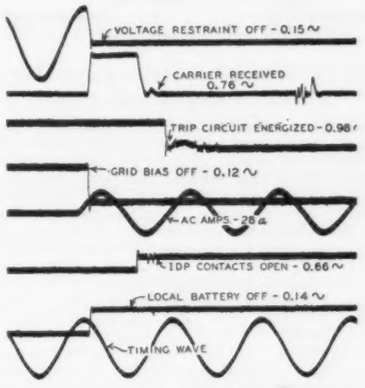

VOLTAGE RESTRAINT OFF - 0.15 ~
CARRIER RECEIVED 0.76 ~
TRIP CIRCUIT ENERGIZED - 0.98
GRID BIAS OFF - 0.12 ~
AC AMPS - 26
IDP CONTACTS OPEN - 0.66 ~
LOCAL BATTERY OFF - 0.14 ~
TIMING WAVE

Fig. 2—Trip circuit energized in less than one cycle

High-speed attachment employed on oscillograph made possible reading of time to 0.02 cycle. Time of placing simulated short definitely indicated in the fifth trace from the top. As will also be seen, voltage restraint was removed from the directional relay after 0.15 cycle, bias from the screen grid was removed after 0.12 cycle and the local battery supply from the receiver relay coil was removed after 0.14 cycle. Carrier was received instantaneously after the bias from the screen grid was removed and ceased after 0.76 cycle. The IDP directional relay contacts opened after 0.66 cycle. The difference between the above two intervals is due to inherent lag in the receiver coil. The trip circuit was energized by the closing of the receiver relay contacts after 0.98 cycle. It will be noted from the above that the receiver relay closed its contacts 0.32 cycle after the directional relay contacts opened and 0.22 cycle after the receiver relay coil was completely de-energized, giving a relay time of approximately 0.25 cycle.

For situations involving more sensitive ground fault protection, particularly for conditions where minimum ground fault currents are less than twice normal load currents over the line section involved, the arrangement in Fig. 1 is somewhat modified, but substantially the same arrangement is employed except that in case of a ground fault control is taken away from the phase relays and the ground relay functions independently of the phase relays from a transmitter standpoint.

A high-speed carrier installation has just been completed on the double-circuit 132-kv. line between Cabin Creek and Turner on the system of the Appalachian Electric Power Company. Here the problem of speed was particularly acute, faced as the system was by the necessity of reducing surges to an absolute practical minimum on account of a particularly sensitive series of 2,000- and 2,700-hp. compressors driven by synchronous motors with limited WR^2. A further difficulty introduced was the fact that the line was comparatively short and that, therefore, standard schemes of obtaining relatively high speed, such as instantaneous current relays, left too large a portion of the line unprotected by fast-clearing protection.

Outwardly the installation has substantially the same appearance as that

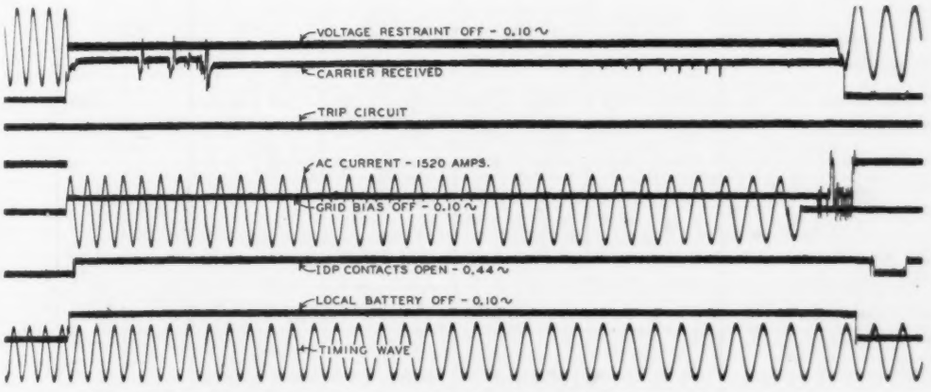

VOLTAGE RESTRAINT OFF - 0.10 ~
CARRIER RECEIVED
TRIP CIRCUIT
AC CURRENT - 1520 AMPS.
GRID BIAS OFF - 0.10 ~
IDP CONTACTS OPEN - 0.44 ~
LOCAL BATTERY OFF - 0.10 ~
TIMING WAVE

Fig. 3—Full blocking of trip circuit for entire duration of short-circuit

Phase-to-phase fault just beyond the Turner substation. As will be seen, voltage restraint from the directional relay, bias from the screen grid and the local battery supply from the receiver relay coil were all removed 0.10 cycle after the short had occurred. Carrier was received instantaneously after the bias from the screen grid was removed and ceased after the fault was cleared. The IDP directional relay contacts opened after 0.44 cycle, stopping transmission at Cabin Creek station, but carrier was received from Turner station, which continued to transmit until the fault was cleared, since the fault current was flowing into the bus at Turner. The PAA lockout relay operated after 3.5 cycles, indicated by the offset in the carrier received element indication.

of other carrier installations previously decribed. [1] [2] Coupling is phase to ground, using porcelain type capacitors of 35 kv. rating, with the carrier equipment located adjacent to the coupling capacitors and the relay equipment forming part of, and being located close to, the other switchboard equipment. Connection between the two consists of an underground six-conductor standard control cable.

It was felt that because of the newness of the idea it would be necessary, before cutting the equipment into operation, to test thoroughly the functioning of its component parts, as well as the performance of the equipment as a whole. For this purpose a number of simulated short circuits with phantom currents applied to the secondaries of the current transformers were made, using a high-speed oscillograph. This not only eliminated the possibility of the placing of unnecessary short circuits on the system later on for the final tests, but gave an accurate check of the performance on the various component parts. Results of one test are shown in Fig. 2.

With the above check on the functioning of the various component parts, a series of short circuits, both internal and external, on the Cabin Creek - Turner line, totaling some fifteen, were made, both phase to phase and phase to ground. The usual methods employed in such testing were followed through, a back-up breaker being provided for the breaker under test and oscillographic equipment being employed at the two ends of the line. A typical oscillogram of an external fault is shown in Fig. 3 and a typical oscillogram of a phase-to-phase internal fault in Fig. 4.

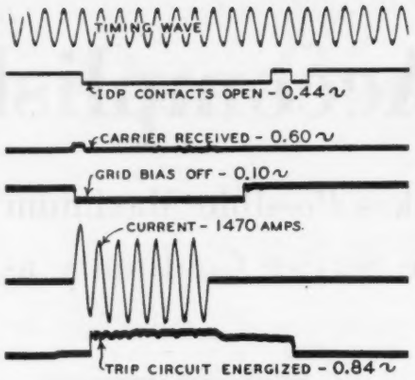


Fig. 4—Internal phase-to-phase short circuit cleared in 0.84 cycle

Blocking removed in 0.60 cycle and trip circuit energized in 0.84 cycle after the inception of short circuit.

Bias from the screen grid was removed 0.10 cycle after the short had occurred. Carrier was received instantaneously after the bias from the screen grid was removed and continued to be received for 0.60 cycle after the fault had occurred. The IDP directional relay contacts opened after 0.44 cycle, stopping transmission at Cabin Creek station. The trip circuit of the circuit breaker was energized after 0.84 cycle, when the receiver relay contacts closed. The fault current was equal to 1,470 primary amperes, which produced a secondary current of 36.8 amperes, which was 7.36 times pick-up current of the instantaneous SC-3 overcurrent relays.

A summary of eight of the tests made covering both phase-to-phase and phase-to-ground conditions, internal and external, is shown in the table. It will be noted that for external faults carrier was transmitted from the station where the power flow was from the line into the bus and was received at both stations during the entire time the fault was on the system. Furthermore, in no case did the receiver relay contacts close to energize the trip circuit. On the internal faults, which were all made with the oil circuit breaker at the Turner end open, it will be noted that the directional-relay contacts opened from 0.44 to 0.70 cycle, depending upon the magnitude of the fault current. Further, it will be seen that in practically all cases voltage restraint, grid bias and local battery were removed after 0.10 cycle and that after the directional-relay contacts opened the receiver contacts closed with an elapsed time of from 0.20 to 0.30 cycle.

The average time of functioning for the receiver contacts to close was well below a cycle, but it is apparent that if a fault current is sufficient to open the directional-relay contacts within less than 0.60 cycle, the tripping time can always be made less than one cycle. In this connection the developments in directional relays now under way hold out promise of cutting the time of the present directional relays in two; this will therefore make possible the reducing of the total time of tripping to the neighborhood of 0.75 cycle. The results to date, however, including complete tests, fully justify the belief that a one-cycle system is practical and could be obtained without material complications as contrasted with systems heretofore developed.

The breaker speeds attainable at the time carrier was first developed on a practical basis were of the order of 5-8 cycles. The development of the breaker art definitely called for a faster relay system. This is now an accomplished fact.

Carrier Relaying Tests on American Gas & Electric System

	External Faults								Internal Faults							
Test no.	1		2		3		4		5		6		7		8	
Time of test	11:23 P.M.		11:57 P.M.		12:18 A.M.		12:45 A.M.		12:58 A.M.		1:18 A.M.		1:33 A.M.		1:35 A.M	
Type of fault	ϕ1-ϕ2		ϕ1-GRD.		ϕ3-GRD.		ϕ3-ϕ2		ϕ1-ϕ2		ϕ1-GRD.		ϕ1-ϕ2		ϕ1-ϕ2	
Station	Turner	Cabin Creek	Turner	Cabin Creek	Turner	Cabin Creek	Turner	Cabin Creek	Turner	Cabin Creek	Turner	Cabin Creek	Turner	Cabin Creek	Turner	Cabin Creek
Primary amps.	1,520	1,520	1,560	1,560	1,520	1,520	1,104	1,104	.....	1,470	.....	980	.....	1,470	.....	1,470
Secondary amps.	34.0	38.0	34.5	39.0	34.0	38.0	23.6	27.6	.....	36.8	.....	24.5	.....	36.8	.....	36.8
Times pick up	6.80	7.60	6.90	7.80	6.80	7.60	4.72	5.52	.....	7.35	.....	4.90	.....	7.35	.....	7.35
Relay tripping time— ~	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.89	.....	1.05	.....	0.84	.....	0.80
Voltage restraint off— ~	0.10	0.10	0.10	0.29	0.10	0.17	0.10	0.20	.....	0.10	.....	0.10	.....	0.10	.....	0.10
Grid bias off— ~	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	.....	0.10	.....	0.10	.....	0.10	.....	0.10
Local battery off— ~	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	.....	0.10	.....	0.10	.....	0.10	.....	0.10
IDP contacts open— ~	.....	0.44	.....	0.79	.....	0.52	1.00	.....	.....	0.55	.....	0.70	.....	0.44	.....	0.50
R.C.C. contacts close— ~	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.89	.....	1.05	.....	0.84	.....	0.80
Carrier received— ~	32.0	32.0	33.0	33.0	30.0	30.0	30.0	30.0	.....	0.70	.....	0.85	.....	0.60	.....	0.65

Survey Technique in Rural Electrification

Bay State Study Costs $60 per Mile of Prospective Extension—Eight Miles Covered in Detail per Week by Each Field Party

IN MAKING the recently completed state-wide rural electrification survey in Massachusetts the F.E.R.A., under J. W. Young, director, was obliged to work out its own methods of coverage, as no previous data were available on which to base an estimate of the time and amount of work involved. Massachusetts is roughly 120 miles long by about 50 miles wide, omitting Cape Cod, and the total area of the state is 8,266 square miles. It was assumed that probably 2,000 miles of line extensions would be uncovered, and since it was known that recent extensions were reaching into territory with four to six customers per mile, it was estimated that the potential customers would total at least 8,000 to 10,000. It was decided to carry on the work in all portions of the state at the same time, so as to have all sections completed as soon as possible.

To administer the project, it was planned to divide the state into districts, each county constituting a district. As a comparatively small amount of survey work was anticipated around Boston, three counties in that vicinity were combined and the two island counties of the state were combined with the nearest land county. Thus, ten districts were established, each in charge of a supervisor reporting to the project director at the Boston headquarters. The supervisors were generally civil engineers well acquainted with local roads and other conditions. Each employed and was responsible for the personnel required for work in his territory and for the character of data gathered by the field crews before this material was forwarded to Boston for further use.

Division of field work

The field work was divided between mapping and interviewing prospective customers located on the routes of the proposed extensions.

Mapping was done by field parties of three men each, consisting of a chief and two chainmen. An automobile was furnished by one of the men for transporting the party to and from the locations for survey operations, the owner being reimbursed on a mileage basis. The number of such parties varied from two to twelve for each district, depending on the amount of work in each. The party chiefs were generally civil engineers, qualified by long experience in survey work, and in most cases at least one man in a party had some previous knowledge of distribution line construction.

The field work was conducted as follows:

After securing maps from the local utility showing its existing distribution lines, a reconnaissance trip by a field engineer was made over the roads indicated as unelectrified, quickly to eliminate those not to be included in the survey (generally uninhabited) and to locate feasible roads for a detailed survey by one of the field parties. The party, on arrival at the road designated for survey, would make a brief sketch of the last primary pole, noting the number and other pertinent information. Using this as a starting point, and with the surveyor's usual chaining operations, they would measure and make notes of the location of each rural resident or prospective customer along the road, together with all physical features which might have a bearing on the layout of a line. Each extension was numbered and recorded on a master map to indicate its exact location.

All houses and farm buildings along the road were located and each was given an identifying number, together with the owner's name. Soil conditions were determined, the amount of necessary tree trimming was designated and notes made on the location of side roads, gates leading into fields, culverts, bridges, high embankments, fills, etc. The average production for this work was 8 miles per party for a 35-hour week.

When it was impossible to carry on the field work, because of weather or road conditions, the field parties worked in their district offices transcribing notes and mapping surveyed roads to a scale of 400 ft. per inch.

Interviewing prospective customers

The second phase of the field work was the interviewing of prospects, which followed the field survey of the road. As far as possible, men were selected for this part of the work on

[*Continued on page 82*]

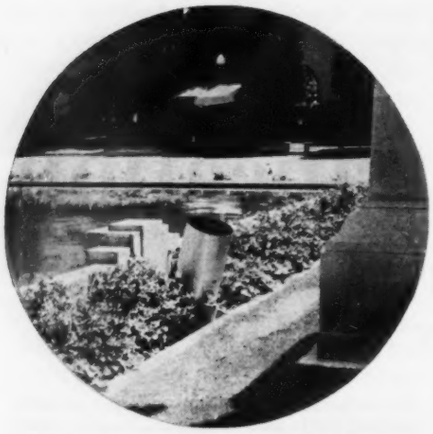
FEDERAL EMERGENCY RELIEF ADMINISTRATION OF MASSACHUSETTS
RURAL ELECTRIFICATION SURVEY
BOSTON, MASSACHUSETTS
BULLETIN #102
RURAL INSPECTOR'S WORK SHEET

County ..... Township..... DOS Map No.... Extension #.... Form #873-F

										Would Install													Distance		Estimated kwh/month		
Map Designation No.	Owner or Tenant	Type and class of customer	Area Cultivated	No. of rooms of residence	No. of Occupants	Building other than residence	Would pay per month for elec. service	Some electric plant?	Gas Engine?	Barn, poultry, yard or other lights	Electric Range	Household Refrigerator	Dairy Refrigerator	Radio	Washing Machine	Shallow Well System	Deep Well System	Water Heater	Other Heating Appliances	Motors 3HP and over No.	Motors 3HP and over HP	Motor appliances under 3HP	From Road	From proposed line	Lights	Appliance under 3HP	Appliance 3HP and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

Questionnaire form used in calls on rural dwellers

Lights and Lighting

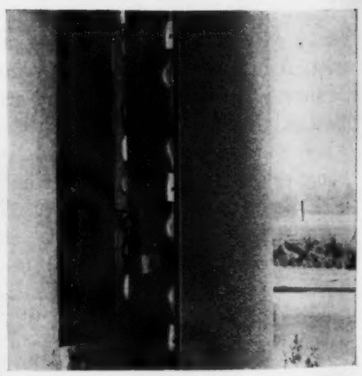


This mortar-like unit, beneath a statue, contains a spotlight hooded to prevent spill light reaching the eye of passersby

SAN DIEGO'S fair, known as the California-Pacific International Exposition, is one of those rare fairs in which buildings and grounds are destined for perpetuation. As a result the electrical installation for lighting and exhibitors' uses has many characteristics of a permanent job. Main distribution feed for the fair is from two substations of 3,500 and 6,000 kva. capacity, each supplied from two 11½-kv. lines of the San Diego Consolidated Gas & Electric company. Distribution is at 4,000 volts through underground lead sheath varnished cable feeders to individual substations in each building. Three-phase power is supplied as required from open-delta banks at these points. The substation at the Ford building, for instance, carries a connected load of 2,000 kw. with a 1,090-kw. peak, while other exhibitors' requirements run from 6 to 35 watts per square foot.

Concealed in the box-like top of this pergola are units which throw multi-colored lights on the surrounding eucalyptus trees. High up on the tree at the extreme right may be seen another unit pointed upward

White light to illuminate flower gardens is directed downward from mission-bell reflectors studded with green glass beads through which light shines, giving the units a low intensity glow



View showing details of the vertical strips which conceal lights for the fluted exterior of the Ford building

A single exception to the Spanish or Aztec architecture, the Ford building consists of two cylindrical structures. The first or entrance structure is fluted and white light provided by incandescent lamps concealed in vertical troughs illuminates its exterior. Louvered skylights, in which mercury vapor and incandescent lamps are combined, light the interior of the building, providing an intensity of 30 ft.-candles on the floor level 30 ft. below

at the San Diego Fair

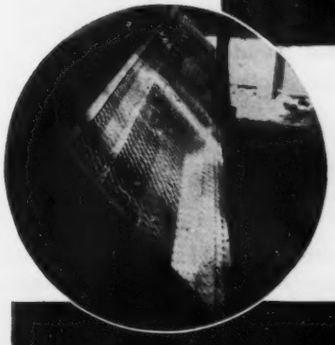
Colored Spot, Flood and Trough Lights Extensively Used to Enhance the Spanish and Aztec Architecture

Simple modernistic street standards are used for general ground lighting

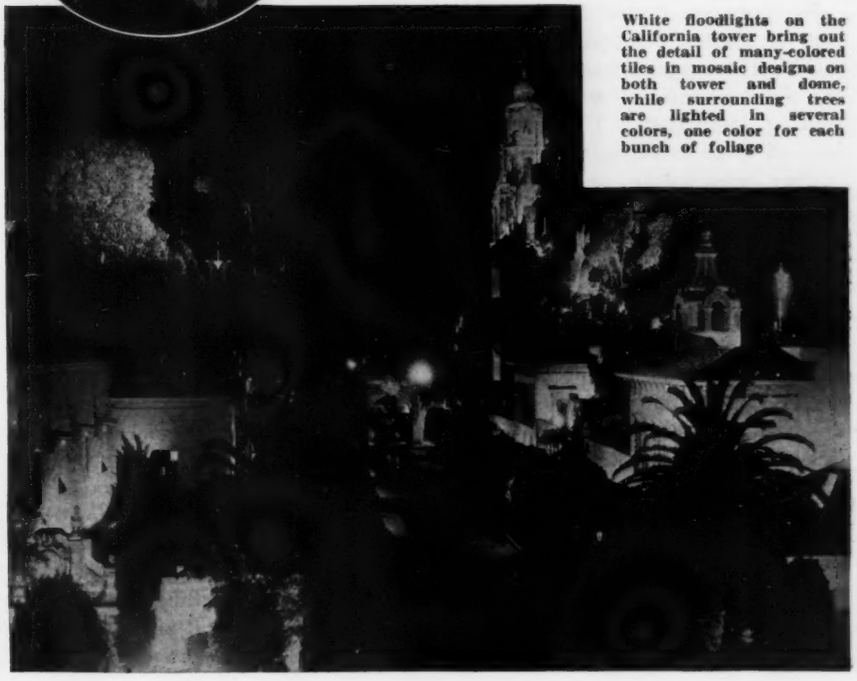
"Birdhouses" are used to conceal floodlights which illuminate the buildings

Mirror-like pools reflect the floodlighted buildings and trees surrounding them, enhancing the effect produced by the blue, rose and amber colored lights, directed on the buildings from trough-type units concealed in the foliage.

Fifteen colored sun arc spots, fed from a motor-generator set, revolve atop the organ pavilion, creating the effect of "northern lights"

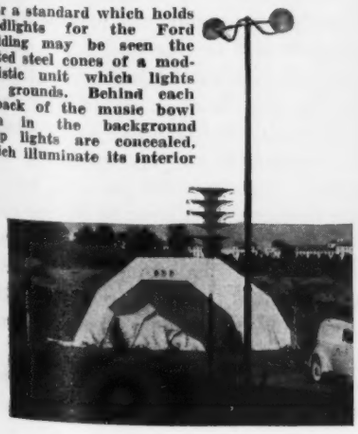


A typical installation, this footlight trough, placed alongside a building, is concealed from view by a wall and foliage



White floodlights on the California tower bring out the detail of many-colored tiles in mosaic designs on both tower and dome, while surrounding trees are lighted in several colors, one color for each bunch of foliage

Near a standard which holds floodlights for the Ford building may be seen the nested steel cones of a modernistic unit which lights the grounds. Behind each setback of the music bowl seen in the background strip lights are concealed, which illuminate its interior



Effective Ways to Stop Energy Diversion

Successful Methods for Prevention of Energy Diversion—Where Will They Pay?—Data from Installing Meters on Transformer Poles

Meter connection boxes and detachable meters in metal-inclosed services will effectively reduce energy diversion even when used indoors.

Reconstruction of all old-style services on which tampering is suspected is economically justified. This is particularly true of small commercial installations. Reconstruction of all services in suspect territory may be of economic value, but any data attempting to prove this are difficult to procure and may be unreliable.

The full benefits of new sequence metering will be realized only if a strict and rigid enforcement of sealing is maintained. No installation of tamper-proof service is tamper-proof if the customers are allowed to break the seals without consequences.

It is futile to attempt to prevent tampering on open wire services by any meter attachments or devices. Close inspection by metermen for evidence of tampering and an alert billing department are the only means of finding suspects and the reconstruction of the service is the only cure.

By E. E. KLINE

Superintendent Electric Meters, Union Gas & Electric Company, Cincinnati, Ohio

THE opening conclusions result from a field study of energy diversion begun by the Union Gas & Electric Company in April, 1933. The purpose was to determine the most economical method of preventing tampering. The study has been of value in setting up a policy of tamper investigation, in rehabilitating suspected customers' metering and in preparing specifications for new and reconstructed services.

Installing a meter on the secondary side of the distribution transformer serving a given locality, then comparing the registration of this meter with the sum of the registrations of the individual meters on customers' premises served by this transformer was the method used. Allowance was made for meter potential coil losses and service line losses at the rate of 1½ watts per service. Twenty-two service transformers were supplied with these tab meters. The number of customers on each transformer ranged from 6 to 111, with most installations between 20 and 40 customers.

Picked suspected territories were selected for this field study for the reason that the preventive measures taken would therein do the most good and at the same time provide sufficient contrast to indicate clearly the effectiveness of the different methods. These localities included streets in the vicinity of a racetrack—particularly a logical place to find tamperers. Some streets selected were tenement districts, where poverty is the reason for the prevalence of tampering. And also, "just in case," some average sections of territories were chosen. It should be emphasized that in none of these territories selected were there any of the better customer sections where energy diversion is comparatively low.

After taking readings on the installations for several months, in order to determine the average amounts of unaccounted-for energy, four methods of tamper prevention were tried out, as follows:

I—For Services in Conduit

1. Meter connection boxes—The boxes used are sheet metal indoor test block boxes with meter trims. They are installed in conduit and with meter ahead of switch and fuses (new sequence).
2. Detachable meters—These meters are installed indoors in conduit and with meter ahead of switch and fuses.

II—For Open-Wire Services

The company still has a great many old-style open-wire services on which it is obviously useless to install meter connection boxes of detachable meters without first reconstructing the service. Therefore it was considered worth while to try the following two methods to see if it would be possible to reduce energy diversion on such services to an economical level without going to the expense of service reconstruction.

1. U-jumper prevention devices—These devices, applicable to conventional watt-hour meters, are specially constructed so that if a U-jumper is placed on the meter it will run at full-load speed regardless of the actual load as long as the jumper is in position and there is potential on the meter.
2. Glass terminal shields—These shields consist of small glass tubes which fit over the ends of the wires entering the meter terminal chambers and render the use of the U-jumpers more difficult.

Unaccounted-for energy in the suspect territories studied before any of the services were changed was 14.4 per cent of the energy delivered. This is charged wholly to energy diversion, though some small part may be due to grounds and to line and meter potential coil losses not adequately allowed for by the estimate of 1½ watts per service. It was found that unaccounted-for energy in suspect territories frequently rose over 30 per cent, and in one instance even went to 40 per cent.

One of the service transformers supplying more than one hundred customers in a tenement section of the city where tampering is quite prevalent surprisingly showed only a moderate amount of unaccounted-for energy. It was concluded that while

the number of tamperers among this poorer class of customers is high, they do not divert much energy because they have so few lights and appliances to use. Therefore, the decision as to the economic justification of reconstructing services with tamper-proof equipment cannot necessarily be determined by the prevalence of tamperers in the territory, but rather by the amount of energy diverted per customer. However, the fact cannot be overlooked that small amounts of energy would fall in the higher brackets of energy charge if properly metered, whereas large amounts of energy would be billed for the most part in the lower brackets.

The investigation shows that probably the most fertile field for conversion of suspect territory equipment to tamper-proof installations is among the moderate and heavy users of energy rather than among the small users, even though there be more tamperers among the latter. But, of course, this refers to territories where energy diversion is prevalent.

Referring to Table II, it will be noticed that energy diversion is effectively reduced by meter connection boxes and detachable meters installed in new-sequence, all-metal services. However, in the meter connection box installations the energy diversion increases somewhat in several cases a few months after the installation. Subsequent inspection of services revealed broken seals on some of the boxes—a clear indication of tampering. But as long as the seal has to be broken and cannot be duplicated by the tamperer, energy diversion cannot be carried on for very long without detection. This is true only on new sequence installations, for the reason that these are the only installations on which it is practical to enforce a sealing program.

On old-style, metal-inclosed installations with fuses ahead of the meter the utility cannot enforce fuse-box sealing vigorously, because in case of a blown fuse the customer is obliged, thereby, to call the electric trouble de-

[*Continued on page 84*]

Table I—Comparison of Service Transformer Output With Collective Registration of Corresponding Customer's Meters

Applies to a typical area where tampering was prevalent

Billing Period	No. of Customers	Kw.-Hr. Registered Customer's Meters	Kw.-Hr. Meter Loss	Kw.-Hr. Registered Plus Meter Loss	Kw.-Hr. Output Service Trans. Meter†	Kw.-Hr. Unaccounted for	Per Cent Unaccounted for
Feb. 14-March 15.....	18	690	19	709	995	286	28.8
March 15-April 16.....	18	687	21	708	1,055	347	32.9
April 16-May 15.....	19	655	20	675	1,049	374	35.7
May 15-June 14.....	18	697	20	717	985	268	27.2
June 14-July 16.....	18	673	21	694	971	277	27.5
July 16-Aug. 15.....	18	788*	19	807*	875*	68*	7.8*
Aug. 15-Sept. 14.....	18	753*	19	772*	778*	6*	0.8*
Sept. 14-Oct. 16.....	18	877	21	898	910	12	1.3
Oct. 16-Nov. 14.....	18	822	19	841	843	2	0.2

*Detachable meters installed indoors on all services. Started 7-30-34, completed 9-6-34.
†Adjusted for test meter and service line losses at 1½ watts per service.

Table II—Percentage of Energy Unaccounted for in Suspect Areas

Figures in light face type indicate unaccounted for energy before installation of corrective means, figures in italic during period of installation and boldface figures after installation. At the feet of certain columns, I indicates meter connection boxes installed; II, meters equipped with U-jumper prevention devices; III, glass terminal shields installed; IV, detachable meters installed, and V, detachable meters installed only on suspect's services. The asterisk(*) in column "L" indicates the substitution of meter connection boxes for the glass terminal shields first installed in this area.

The large negative figures in column "P" were caused by unavoidable delays in reading the meters of certain customers.

A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
17.1		20.9	21.1	7.5	28.8	33.4	37.1	8.2	6.2	19.2	4.0	7.0	9.9	6.9	9.8	—7.1	15.7	12.4	18.9	3.8	13.8
14.6		20.6	22.2	2.7	32.9	24.8	40.8	10.0	3.8	26.5	7.8	14.1	8.2	5.0	14.4	—0.9	17.7	8.6	29.9	2.8	18.6
14.4		21.9	19.9	3.4	35.7	1.3	36.7	5.4	5.3	16.5	9.4	*8.7*	12.0	6.8	14.2	12.5	20.8	13.6	14.5	5.3	17.5
13.0		*13.2*	18.2	2.9	27.2	12.0	32.7	8.5	7.3	15.5	10.1	**7.0**	17.0	5.6	14.0	22.4	17.2	13.5	15.3	6.7	20.0
3.2		**3.7**	*4.8*	10.2	27.5	15.5	*19.3*	11.5	8.9	9.5	9.5	**6.4**	18.3	6.4	14.4	17.6	17.4	15.5	*6.1*	7.1	18.7
4.6		**4.7**	1.2	22.9	*7.8*	*—0.3*	**—0.5**	9.6	5.8	6.3	6.7	**5.2**	20.9	*3.8*	13.3	28.2	20.2	19.3	**4.5**	5.8	21.9
4.1		**10.3**	2.6	*4.7*	0.8	1.2	**—0.7**	9.1	6.6	11.3	7.4	**6.2**	26.5	**8.9**	10.9	—3.2	17.2	10.4	**4.2**	9.3	24.5
4.9		**12.0**	5.5	2.3	1.3	2.0	0.6	14.2	5.8	21.3	6.9	**6.1**	22.5	**3.7**	8.8	6.4	*11.8*	17.2	**1.9**		
2.6	8.0	**11.1**	6.6	3.0	0.2	0.6	1.6	15.4	9.0	26.9	18.8	**5.7**	23.5	**8.6**	8.4	1.1	*10.3*	16.2	**0.8**		
9.5	4.8	**13.3**	9.6	4.3		0.0	—1.1	17.1	4.3	23.2	13.0	**5.4**	17.3	**12.7**		—7.5			—2.2		
14.6	6.1	**13.9**	12.6	4.7		0.9	5.2	14.2	6.9		25.4	**9.5**		**7.2**		—9.8					
13.1	3.8	**13.4**	12.3	5.3		2.9	2.8	9.2	8.1			**9.4**		**10.1**							
11.2	4.6	**13.4**	10.0	4.0		9.2	2.1	13.8	4.5			**8.8**		**8.6**							
	1.8	**12.7**	3.5	2.3		4.8	3.9	13.0	3.8			***5.3**		**6.5**							
		13.7	3.3	1.7		4.4	2.3	14.1	4.1			**4.6**									
						3.2	1.6	12.9	4.5			**4.8**									
						4.1			2.8			**2.5**									
						4.0			4.3			**5.2**									
						—1.1			2.2												
						6.4															
I		II	I	II	IV	I	I					III		II			V		I		

High Frequency for High-Speed Motors

Factors Affecting Selection of Power Sources and Motors for Drives That Require Compact Motors or Omission of Intermediate Transmission

By GEORGE H. HALL
Consulting Engineer
Douglaston, N. Y.

High-frequency motors enter the industrial and utility markets as new tools. The equipment is perfected. Either performance specifications or the elimination of accessory speed-control equipment may warrant the use of these motors. Utility power salesmen, industrial engineers and electrical manufacturers should be interested in this new development. Its full possibilities for use are not yet realized.

WITH the ever-increasing use of alternating-current motors for built-in application to machines, tools and appliances there frequently arises a demand for motors to operate at higher speeds than those obtainable with normal frequency supply. With 60 cycles, for example, the maximum motor speed obtainable is that of a two-pole unit, or 3,600. Higher motor speeds must be obtained by increasing the frequency. If the frequency should be doubled a two-pole motor would operate at 7,200. By the use of other frequencies, and different numbers of poles in the motors, it is possible to obtain virtually any speed that may be desired up to the limits of practical construction.

High-frequency motors are generally employed where they avoid the necessity of intermediate transmissions such as gear, belt or chain drives. Their high running speeds permit comparatively small units for their developed horsepower, which is an advantage in portable tools, machines and appliances whose weight must be minimized. One of the largest fields of application is in wood working, since high spindle speeds are necessary. On wood-working machines having a number of individually driven spindles the compact frame dimensions of high-speed motors are especially adapted for built-in design.

Two generally employed methods of obtaining frequencies in excess of that of the supply line, which we will consider as 60 cycles, involve the use of motor-generators, or frequency converters.

Motor-Generators—A motor-generator employed for frequency changing requires a generator having a sufficient number of poles to produce the desired frequency when running at the speed of the driving motor. The number of generator poles required may be calculated from the basic formula, $P = \frac{F \times 60 \times 2}{\text{R.P.M.}}$. Hence, if a frequency of 120 cycles is desired and we have a driving motor having a speed of 1,800, the generator would require eight poles. Other frequencies can be obtained by using generators having more or less than eight poles or by using motors of a different speed. The limitations to the use of the motor-generator are reached when the desired frequency requires speeds greater than those dictated by good practice or by the expensive and cumbersome construction of generators with an excessive number of poles.

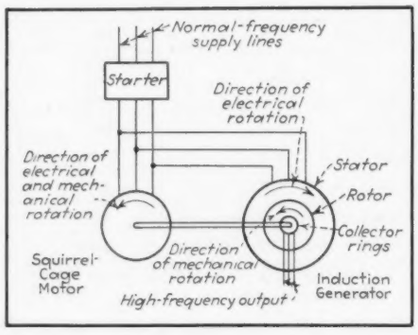
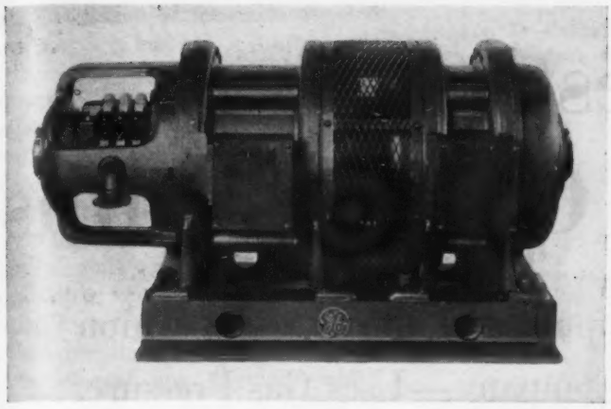
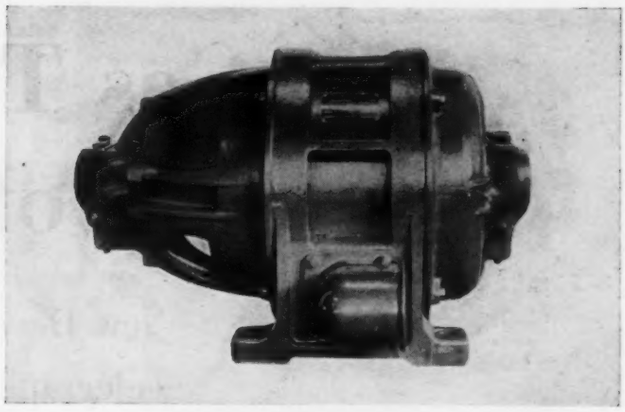


Fig. 1 — Elements of a frequency converter

While the use of motor-generator sets is less common than that of frequency converters, due to higher cost and necessity of attendance, there is a decided advantage in their favor in that the high-frequency output is independent of voltage fluctuations in the supply lines. General practice is in favor of the motor-generator for installations exceeding 100 kw., although the choice should not be made without considering all of the factors of operation and attendance, and weighing any advantages thus secured against the higher first cost. For plants in which direct current only is available, but where motors are to be operated on high-frequency power, only the motor-generator can be employed as the frequency converter is dependent upon alternating-current excitation.

Frequency Converters—A frequency converter consists of a motor-driven induction generator, similar to a wound-rotor motor, but arranged for alternating-current excitation of the stator. Such a generator is essentially a transformer, in which the stator forms the primary winding and the rotor the secondary. If the rotor is held stationary the output frequency will be the same as the supply line and the voltage will be determined by the rotor winding. If the generator is driven in a direction opposite to that of its rotation as a motor, fre-





Figs. 2 and 3—Double- and single-unit induction frequency converters

quency and voltage will be generated proportional to its speed. The output from the frequency converter will therefore consist of a voltage and frequency due to transformer action plus a generated frequency and voltage depending upon its speed. By proper selection of the driving-motor speed and the number of generator poles, we may obtain virtually any frequency needed for the operation of motors.

Expressed as a formula, Output Frequency $= \frac{\text{R.P.M.} \times \text{Poles}}{60 \times 2} +$ Line Frequency.

As an example, consider a frequency converter operated by 440 volts, 60-cycle service for operating 120-cycle, 220-volt motors. A standard 440-volt, 60-cycle induction motor running at 1,800 would be used to drive a four-pole generator. The rotor winding would be such that transformer action would give 110 volts. With the rotor revolving at full synchronous speed the generated output would be 60 cycles, 110 volts, which, added to that supplied by transformer action, results in a total output of 120 cycles, 220 volts.

Since any voltage and frequency, within working limits, may thus be obtained by the use of the frequency converter, it is desirable from practical considerations that certain bases be standardized for the windings of the converters which, when designed for the base voltage and frequency, may be employed for producing any voltage and frequency in the series to which they are adopted. Those which are now generally accepted are classified as follows:

Series	Based on
Normal-frequency	60 cycles, 220 volts
First high-frequency	120 cycles, 220 volts
*Second high-frequency	200 cycles, 114 volts
Portable hand tool and machinery	180 cycles, 220 volts

*Generally adopted, but not yet standardized.

The frequencies and voltages available by use of frequency converters designed upon these bases are given in Table I.

Since the total output of a frequency converter is the sum of the generated output and that supplied by transformer action, the motor used for driving the converter need be only large enough to develop the generated portion of the total output. Therefore the motor will be considerably smaller than would be needed in a motor-generator set in which the total high-frequency output is supplied by the generator. For a converter to operate on 60 cycles and deliver 60 kw. at 90 cycles, 60/90ths of the total output, or 40 kw., would be due to transformer action, leaving but 20 kw. to be generated. This would require a driving motor of but 30 hp., whereas a motor-generator would require one of 90 hp.

Frequencies below normal may be obtained by running the converter in the direction of phase rotation of the stator, but for reduced frequencies or for those but slightly above normal the motor-generator is generally preferable to the converter. At the low frequency points the converter efficiency is poor and, due to slow speeds, the ventilation is inadequate so that high operating temperatures may occur. As a working limitation it is considered good practice to employ the converter only when the output frequency is at least 25 per cent above normal. On the established 60-cycle basis this would indicate the use of converters for output frequencies of 75 cycles and above.

For limited conditions a single-unit converter may sometimes be used to advantage. This type of converter is similar in construction and appearance to the wound-rotor motor, the high frequency being taken from the collector rings. For 60/180-cycle conversion the stator would be equipped with a 4/8-pole winding. The four-pole flux acts on the rotor winding, causing it to rotate at 1,800 r.p.m., while the eight-pole flux acts as in the conventional converter, generating a frequency of 120 cycles, which, added to the supply frequency, results in an output frequency of 180 cycles. Similarly, by using a 2/8-pole combination running at 3,600 r.p.m. an output frequency of 300 cycles may be obtained.

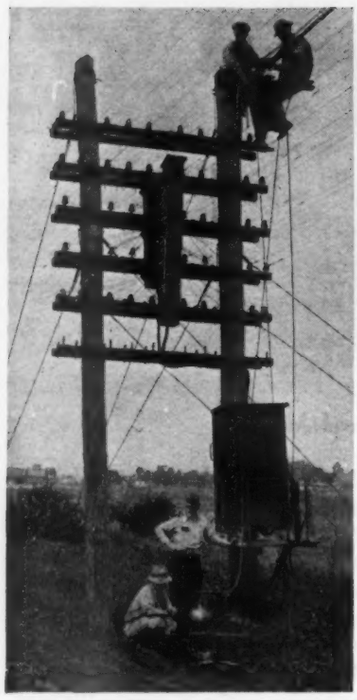
The primary of a converter may be wound for operation on either two- or three-phase power, but the secondary is almost invariably built for three-phase output. Consequently, the mo-

[*Continued on page 90*]

Output Voltage and Frequency Values in General Use

The base figures represent the frequencies and voltages for which the converters are built. The succeeding ratings are the frequencies and voltages for which converters of each series may be used.

Based on Cycles	Normal-Frequency Series 60 Cycle, 220 Volts Volts	First High-Frequency Series 120 Cycle, 220 Volts Volts	Second High-Frequency Series 200 Cycle, 114 Volts Volts
75	275	...	...
80	293	...	...
90	330	...	...
100	367	183	...
120	440	220	...
150	...	275	...
180	...	330	...
200	...	...	114
240	...	...	137
300	...	...	171
360	...	...	205
420	...	...	240
480	...	...	274
540	...	...	308
	Portable-Hand-Tool Series		
175	214	...	...
180	220	...	...



Gas testing on aerial cable

Gas Testing of Cable Sheaths

New Development of the Western Union Telegraph Company—Uses Gas Pressure, Wax Dams and Special Equipment

By D. P. DICKIE

Assistant Engineer of Lines Western Union Telegraph Company

NOTEWORTHY improvements in the practice of testing communication cables with gas to determine the integrity of their sheaths have recently been made by the engineers of the Western Union Telegraph Company. The following is a general outline of the gas-testing procedure now employed by the telegraph company and a brief discussion of several of the more important developments in testing methods and equipment.

Communication cable employed in outside telephone and telegraph plant is predominantly of the paper-insulated, lead-sheathed variety. Since the paper used in such cables is not impregnated in any way, its effectiveness as insulation is entirely dependent on the exclusion of moisture from the core, and hence on the maintaining of the sheath airtight.

Lead sheathing unfortunately is extremely susceptible to mechanical injury. Where cables are carried aerially on pole lines considerable trouble is experienced as a result of thrown stones, gunshots and the abrasive action of the rings employed to support the cable. Underground cables are often injured while work is being performed in the manholes and during excavation work on the part of other companies. Such cables are also susceptible to electrolysis.

While much can be and has been done to ameliorate the causes of trouble, it is evident that some of them cannot be controlled. By reason of this fact, the only available course is constantly to watch the cables with a view to the detection of faults or injuries before they have progressed to the point where the operation of the plant is jeopardized. Until recently dependence was placed on close and frequent visual inspections. Such inspections, if thorough, were costly, and even where carried on painstakingly seldom revealed any but the larger defects. It was with a view to the obtaining of a more precise and dependable means of fault protection that gas testing was taken up by the major communication companies several years ago.

Principle of testing

Briefly, the principle of gas testing is as follows: A gas, usually oil-pumped nitrogen, is injected into the cable, filling the interstices between the conductors until a pressure of from 10 to 20 lb. per square inch is built up within the sheath. The presence of defects at splices is then determined by painting the splice with a soap solution and watching for bubbles. The presence of defects in lengths of cable between splices is determined by measuring pressures at points along the cable and plotting graphically the pressure gradient with respect to the length of the cable. Low points in the curve so obtained theoretically indicate the location of the leaks.

This is a new method used to test cables. While used on communication cables, it should have a wide application in the utility field. Cable engineers and manufacturers should note this new development.

In order to obtain a dependable pressure gradient, the gas must be prevented from escaping in any way except through the faults which are being sought. This is done by dividing the cable into gastight sections by means of dams at the ends of the cable and at intermediate points, usually about 2½ miles apart.

The problem of developing a dam that was satisfactory and that could be installed economically was a difficult one. Originally the attempt was made to sectionalize the cable and seal its ends by introducing hot paraffin or some other compound into certain of the splices. Such dams seldom proved satisfactory, since minute cracks almost invariably opened up in the sealing material as a result of the unequal coefficient of expansion of the compound, the splicing sleeve, the paper insulation and the conductors. After a great deal of experimentation, during which many types and varieties of dams were tried out, the Western Union was successful in developing what is known as the tri-sectional dam.

This dam can be installed at any desired point in a cable. When the location for the dam has been deter-

mined a section of the cable about 4 ft. in length is heated. A mineral wax is then injected under high pressure through an inlet in the sheath near the center of the heated section. This wax is allowed to cool. The central portion of the impregnated length is then reheated and a mixture of mineral wax and rosin oil injected. This latter material seals effectively any minute cracks that have opened in the wax during its period of cooling and, since it remains in a semi-viscous state, serves to seal any openings which may subsequently occur by reason of temperature changes.

Cable preheated for wax dams

The apparatus used in preheating the cable section before introducing the wax for making a dam is shown in Fig. 1. A jacket is formed around the cable by means of a section of split rubber hose, which is closed by winding with rubber tape. Steam generated by a low-pressure steam boiler is fed into the jacket, thus raising the temperature of the cable to the required point.

The wax used in making the cable dam is introduced into the cable by means of the combination wax tank and high pressure pump shown in Fig. 2. Heating is accomplished by placing the tank on an ordinary splicer's furnace and the wax is injected into the cable by the hand-operated pump.

After dams have been established at the desired points in the cable to be tested, gas valves are installed at each end of each test section and at intermediate half-mile points. The sheath is first punctured by means of a sheath punch, comprising a cutter with beveled teeth. This cutter is of such a length that it penetrates only about nine-tenths of the thickness of the sheath. Continued rotation of the tool, however, causes the remainder of the small disk of lead to disengage itself by a shearing action. In this way the teeth are prevented from ever coming into contact with or injuring the paper insulation of the cable.

Various steps in the installation of a gas valve are shown in Fig. 3. After the sheath is perforated the valve stem is inserted into the hole. To effect a thoroughly gastight connection and to insure mechanical rigidity for the stem a small collar of pressed metal which is bent to conform to the curvature of the cable is placed around the stem and filled with solder. Standard tire valve insides are employed in the valve stems. In order to guard further against gas leakage the stem is sealed by means of a small interior cap and an exterior cap, the lower edge of which is beveled and cuts into and seats itself thoroughly in the solder about the base. The inlets employed for admitting wax are attached in a similar manner. These inlets, however, are simply provided with a standard pipe cap.

When the valves have been installed the cable is ready for test. The nitrogen gas is admitted through one of the air valves, preferably one near the center of the section. After the pressure within the cable has had sufficient opportunity to become equalized initial pressure readings to determine the preliminary pressure curve are taken at all valves. These readings are taken with mercury manometers. A typical preliminary pressure curve is shown in Fig. 4. The point at which the two extended pressure gradients meet indicates approximate location of leak.

As a general rule the preliminary pressure curve is inadequate to indicate the exact location of any but the largest type of leaks. To locate leaks not definitely revealed by this curve, it is necessary to obtain pressure readings at more closely adjacent points within the section under observation. To obtain these readings without disturbing the existing pressure gradient and without loss of gas temporary valves of the type shown in Fig. 5 (page 92) are used.

The temporary valve contains a cutter similar to that employed in the sheath punch, which, when the instrument is clamped to the cable, operates within a space sealed to the atmosphere. After the sheath has been perforated the pressure within the cable can be determined by attaching the manometer hose to the valve stem at

[*Continued on page 92*]

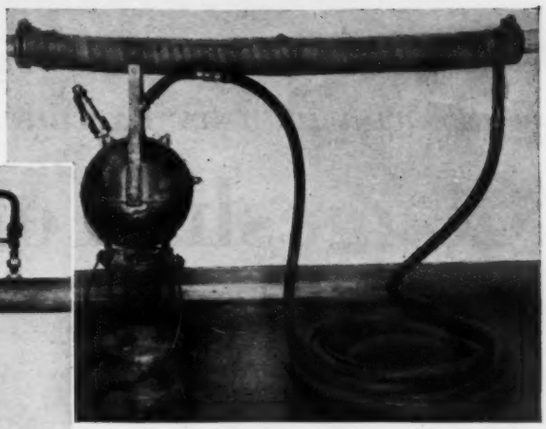


Fig. 1—Cable is heated to introduce wax dam

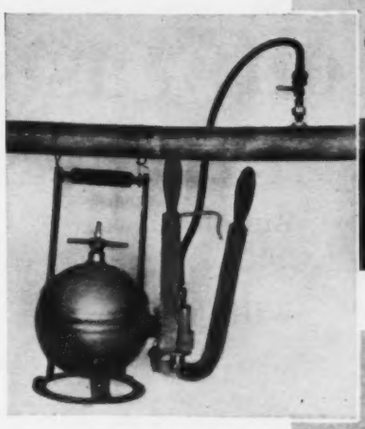


Fig. 2—Wax is forced into cable by pumping

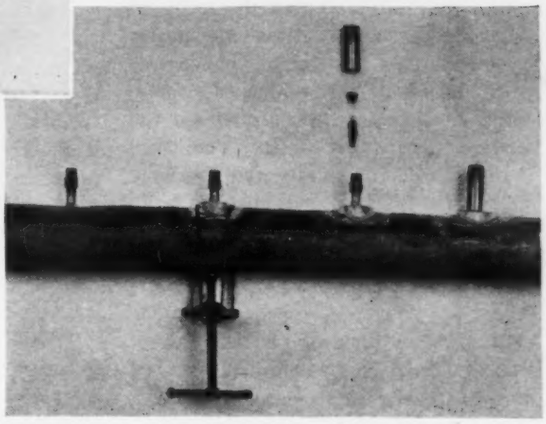


Fig. 3—Gas valve is inserted for test

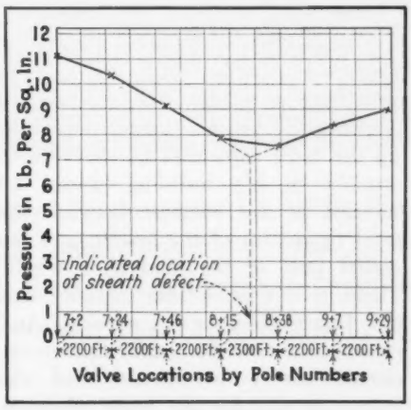


Fig. 4—Typical pressure curve to show fault

One of a Series of Intimate Talks with Industry Executives

Coggeshall on Waste in Wiring

An Interview by

EARL WHITEHORNE

REALIZATION is growing among electrical men that one of the major present problems of the industry centers round the cost of wiring. The clash between the power company and contractor viewpoints over the use of new and cheaper materials, which has been argued for ten years, is only part of it. The issue is not whether code requirements should be relaxed, but how to make more adequate installations of interior wiring cost less. There is a deal of difference.

Nobody questions the necessity for maintaining a high standard of safety. But how will we get people to put in more outlets when it costs so much? That's the way the thinking has gone. The answer will probably evolve through a compromise that will find economy through radically different methods of installing quality materials, some of them quite new. Progress usually comes that way.

It is an intriguing subject and a lot of men are dreaming about it these days. I have just been talking with one of them, who has been mentally exploring the possibilities in a definite direction — Allan Coggeshall, president of Hatzel & Buehler, Inc., nationally known engineers and contractors, with headquarters in New York. Coggeshall has had a wide experience and he's a thinker. He has been actively interested in this controversy over the cost of wiring for years. Here is his angle on it.

Waste, not cost

"The entire electrical industry stands a victim," he said, "of our outgrown radial system of distributing electricity. Both the utility and the contractor are involved in it, and so is the customer. And so long as we perpetuate this traditional structure of long radial feeders and circuits its inherent high costs will continue.

"It is the natural outgrowth of early days. We build a power house and radiate distribution lines out from it. We receive power service at a meter board and radiate circuits through the building. But we have now built up electric service to proportions undreamed of when this plan of distribution was adopted.

Utilities facing it

"Already the utilities have tied their radial system together into a network to make capacity more widely available, and they are now decentralizing the sources of power by scattering small stations around, close to the load. Central super-power plants are no longer economic. And I believe that we face the same conditions in interior distribution. We have reached a point where the contractor must wire a building for perhaps five times the pulling load, in order to give the system sufficient capacity at all points, which is not economic. And it is this waste in wiring that is causing this high cost and limiting the adequacy of installations today."

"How can this be overcome in interior wiring?" I asked.

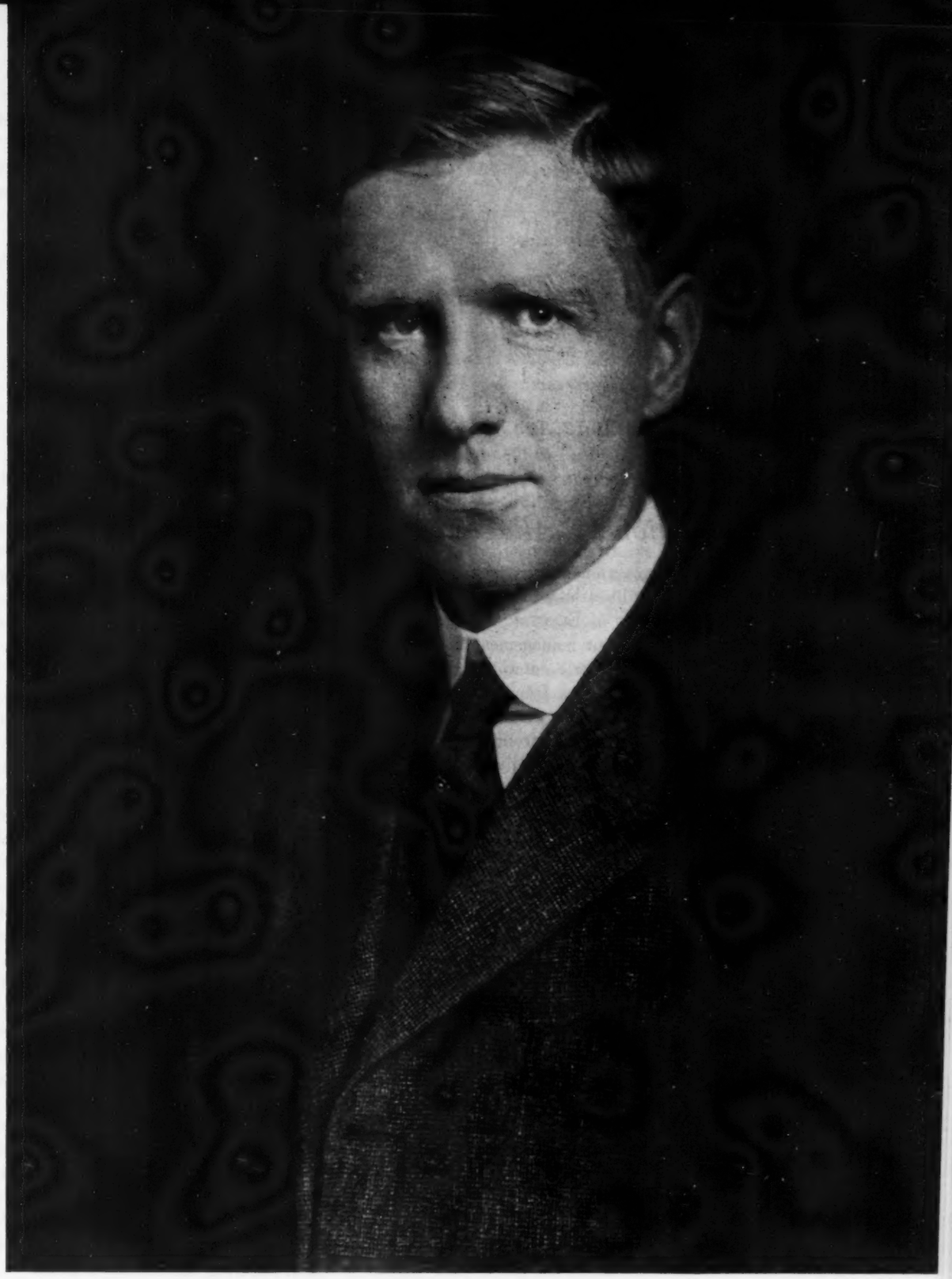
"By more accurate knowledge of the probable requirements of the installation and better engineering in providing the capacity," Coggeshall continued. "Any consumer who added up the total capacities of the various circuits in his building would be startled at the contrast between the total capacities of the system and the actual pull of the load as a whole. There is too much idle capacity and it is just plain poor engineering. And if we could save the cost of this excess circuit wiring we would find the money to pay for the more adequate supply of outlets that the industry is clamoring for and the customer is entitled to for the price he is now paying."

Coggeshall does not offer a complete specification as to how this can be done. He is also groping—but in a direction—to cut down this burden of radial circuits. Perhaps we should decentralize panel control, he thinks, by running interior feeders closer to load areas. Perhaps small circuit breakers can provide protection along the feeder or bus and thus shorten the local individual wiring. Maybe we'll use more vertical feeders or circle the building with a bus or several sections of bus. Perhaps the utility will extend its secondaries up apartment houses, outside the kitchen wall, or, where the underground parallels a big factory building, run service in at several points instead of one.

Tradition must bend

"Let's try a new approach to this problem," he says. "The cost of a 100-amp. unit of wiring is almost as fixed as the cost of generating a unit of power. But when the code says to provide a separate branch circuit for an appliance, the real intent is, just to make the necessary capacity safely available at that point. My plea, therefore, is for better understanding of operating characteristics and an escape from the stereotyped radial design of systems.

"The cost of generating capacity has been dwindling, but the cost of distributing electricity has been increasing steadily and must continue as the use grows. We must face the changed conditions and plan for heavy loads instead of light ones. The engineering tradition must bend to the economic pressure and also recognize the social responsibilities involved. If we are to bring electric service into abundant use it must be at a low cost and we must be willing to scrap anything in our present commercial practice that stands in the way."



Underwood & Underwo

ALLAN COGGESHALL, president Hatzel & Buehler, Inc., nationally known engineers and contractors of New York, has been studying the problem of wiring costs from its engineering, economic and social standpoint. He indicates a way toward a possible solution.

ELECTRICAL WORLD

L. W. W. MORROW • EDITOR

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An Affirmation of Allegiance

OPPOSITION to government ownership and operation of electric utilities as well as all other businesses is the fixed policy of ELECTRICAL WORLD. We believe that more competent management and greater public good come from private enterprise. However, this policy does not prevent us from recognizing new engineering developments where they exist in governmental undertakings nor stop us from publishing the news values in these governmental activities. We print all electrical news impartially and all new engineering developments that are of interest to the electrical industry.

Because of the unbalanced preoccupation of the present Administration with electric power matters, there is a large amount of engineering and news material that is of value and interest to our readers and we shall continue to publish these articles and items as a service to the industry. This action does not mean that ELECTRICAL WORLD is weakening in its editorial policy or is being seduced to the worship in the temples of the New Deal.

On the contrary, the policy of ELECTRICAL WORLD is more intransigently opposed to government ownership—national, state, district and local—than ever before, because each day's developments and each new project bring out new evidence that the private ownership and management of utilities is in the public interest. Boulder Dam, the T.V.A., Grand Coulee, Passamaquoddy and other projects afford the economic data and the political action to prove that private enterprise is in the public interest. The evidence grows daily to support our editorial opinion and we are continually watchful to bring out the facts to support this conclusion.

Because ELECTRICAL WORLD has been identified with the electrical industry from its very beginning and has seen the splendid job in service to users, in efficiency in operation, in development of the art and in intelligent management that has been done by private enterprise there is an allegiance to the principle of private ownership that is in no way disturbed by the events and turmoils of the day. There have been no benefits disclosed by the Administration's adventures in and encouragement of government ownership. The results to date are entirely negative and time will develop the complete facts that will show the public the fallacies of the principle of collectivism as applied to public utilities in this New Deal. The skies are clearing for the private utilities and we have complete faith in their future.

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The Other Side of Fire Prevention

THIS is Fire Prevention Week. It ought to be an important week to electrical men, for there are still too many electrical fires and they come from such simple and avoidable causes. Nine out of ten of them come from misuse of electrical equipment. Much of the trouble is chargeable to sub-standard cords on lamps and appliances. It all contributes a vital weakness in the service rendered by the electrical industry to the public.

But there is another side to it that should move all power companies to decisive action, even if the moral responsibility and the obligation to their customers does not. The industry is answering more than ten million trouble calls each year, because service equipment is not kept in repair and these risks prevail. Some 80 per cent of these trouble calls occur between the electrical outlet and the current-consuming device. It costs from 25 cents to $2 to make one of these calls, depending on its nature and the distance. Twenty minutes time is required on the average. For more serious troubles a contractor has to be called in and an appliance is out of service and off the meter. It costs the industry many millions of dollars annually to take care of these emergencies—nobody knows how much—and for the most part it is waste.

Isn't it about time that electrical men faced this situation? Prevention is always less painful than cure and it would probably cost the industry but a small part of the present expense of trouble calls and outage to set up an inspection service that could periodically check up on these hazardous conditions. And this takes no account of the customers' loss through damaged property, to say nothing of personal injury, pain and suffering and mental anguish—to use the ripe old phrase. It is really doubtful if such an inspection service would cost anything, because of the many more lights and appliances that would be sold, the lamp size increases and the out-of-order equipment that would be restored to use.

Such a campaign would call for an effective industry co-ordination, public education and the co-operation of the present inspection authorities. But it would involve no more labor than the present emer-

gency relief that goes on in every city. Self-interest should win the support of every one involved. And the public benefits that are offered should insure popular approval. It can be done.

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Should the Tap-Changer Be Integral or Separate?

WHETHER newly developed accessories shall become integral with the devices with which they function or preserve their identity is a question not easily answered. Take the tap-changer, for example. Either way may prove to have the advantage as to combined initial cost. But there are the equally important matters of installation, risk of outage, maintenance and space occupied. If all transformers—all sizes, all voltages—were to be ordered with tap-changers the device would almost certainly become an integral part of the transformer. But this is not the case and may never be.

Whichever practice is the case, no kind of failure of the control circuit should cause a failure of the power circuit. Nor should an electrical failure in the control circuit lead to a mechanical failure of the tap-changing mechanism. Sequence of functions should be such that arcing will be kept outside the main transformer tank whatever happens because of tap-change operation. Control of these features is in the hands of the manufacturer.

With all these factors dictating the design, the device is inherently one that is entitled to its separate identity. Whether it is therefore made integral with the transformer or given a detached status is for the purchaser to decide. It is he who knows where the over-all costs will balance, the hazard to service the least, emergency operation the most direct and the maintenance the best. With the decision thus lying in the lap of the operator it would be a good thing to find out what the field has already learned about the advisability of having the tap-changer attached or separate.

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Overweighting Rate Comparisons

FAR too much emphasis is being laid in utility rate cases today upon comparative prices for service. The statistical approach to this subject invariably offers those seeking rate reductions an opportunity to set up impressive exhibits in the form of charts and tabulations, provided the selection of properties is sufficiently hand-picked.

Some weight must of course be given to comparative prices of similar services in adjudicating rates, just as different valuations of a public utility are properly taken into account in studying rate bases and fair returns. Where prices are far out of line for particular residential usages, for instance, those seeking rate reductions are entitled to information as to why this is so. In good commission practice such apparent discrepancies are given consideration, but an experienced tribunal goes very slowly in the direction of regarding rate differences as decisive factors in determining the final tariffs. The wide latitude permitted in many hearings, however, as to testimony and argument, opens the door to substantial waste of time and money in overemphasis of comparative rates. Petitioners too often either do not, or refuse to, realize that identical conditions among properties cannot even be assumed for purposes of argument.

Many pages would be required to list the items of importance which upset the value of purely statistical comparisons of properties for the purpose of seeking a rough common denominator of rate reasonableness. Among these are the "rate legacy" (the history of rate development under a friendly or a hostile atmosphere); character of territory, including ratios of industrial, residential and other business; application of rates which "seem" high or low to specific usages and demands; engineering make-up of plant and lines; use of interconnection; efficiency and obsolescence of generating and substations, and numerous unit values having to do with density of service, use, costs and prices. One cannot blithely "plaster" urban and rural areas with common statistics.

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This Matter of Water Heater Load

WITH more than 200,000 electric water heaters in use in the home and some 34,000 sold in the past two years, no one can argue that the equipment is impractical or cannot be sold. The reasons why so few are sold is something else. And it does not take much study to see that it is just plain lack of serious selling.

In the comparison of the methods and experience of nineteen companies which stood high in water heater sales last year, on pages 70 to 74 of this issue, some interesting points stand out. With water heating rates from 8 mills to 1½ cents, and some higher, the widest diversity of results are obtained. Number of salesmen bears no relation to total sales, because in one city water heaters are really pushed and in another they are neglected, while the pressure goes on something else. On one system the dealers are successfully selling and on another they are shut out. And it all gets down to whether or not they are really trying to build this load.

The question is, how much does the company want this load? Does it want a lot of it? Does it want the load in a hurry so the meters will be turning? The job can be done either way—fast or slow. If this load is wanted quickly, to help carry lower rates and

higher costs, then many salesmen are needed—perhaps four times the present staff—highly organized and adequately supported in a complete, intensive marketing program. And if each salesman pays his way, why not?

One cannot study such a comparison without wondering why there is such a difference in local practice. For after all, this is just a business of selling hot water to homes, and in the main the stimulating methods which have been used by the successful companies can be adopted profitably in other cities. But too often they are not and the salesmen are sent out bare handed. Of course, it takes more than a bag o' tricks, and above all, it is organization and intensity of selling that build the load.

• TRENDS •

THE EDITORS USE A SPOTLIGHT ON CURRENT HAPPENINGS

Costs of Power

IN A TYPICAL plausible address at Boulder Dam President Roosevelt lauded this development as an economical power installation and one that enabled customers to get power at reduced cost. We sometimes wonder who gives out figures on power costs to the Administration, for such a misconception of the power economics of Boulder Dam is hardly explainable. Any engineer who knows the facts finds that Boulder power delivered to Los Angeles is far more expensive than fuel power produced locally at the usual load factor. Power users of lower California instead of getting lower rates are tied up to higher rates over a long period of years as part of the price paid to get the millions spent on the Boulder development. This project may be justified on a flood-control and water-supply basis, but it does not conform to the economics of power supply. This address shows the great importance of bringing out the facts under the topic "National Power Economy" at the World Power Conference next fall. The truth about power costs should and will prevail.

A New Alley

A LEADING women's magazine features an article on how to make the best use of an electric mixer. It is one of a series of practical talks by power company home service women on the use of this important household appliance. This is a good sign. New methods spread slowly under the pressure of ordinary selling, but when the popular periodicals begin to talk to millions of women at a time, pointing out the smart ways to take advantage of these labor savers, the full force of public opinion swings in behind the selling.

Steel Engineers Set Example

WHEN the iron and steel electrical engineers go on inspection trips they go. On one of the afternoons during their recent convention in Pittsburgh they ran over to Weirton to learn how Weirton Steel makes the strip which is the dominant steel product of the industry today. It took an eleven-car special to accommodate the 1,000 who went. Hardly any other electrical association shows such cameraderie and unity of technical objective as the A.I.S.E.E. And the steel executives seem to appreciate how much they owe to these engineers, who have transformed the whole art of steel processing and made the industry one of the most progressive markets for electrical equipment of ever-increasing scope and refinement.

A Message From San Diego

EXPOSITIONS such as the one at San Diego this year provide the electrical industry with boundless possibilities for good-will building and the promotion of electrification. The exquisite lighting effects that at once impress the visitor to the San Diego fair were made possible only through the closest co-operation between power company and exposition lighting engineers and architects. This co-operation is not unusual or reserved for special occasions. Those familiar with the industry know that it is freely extended by the industry to all who need it. But how many utility and industrial customers know this? How many city Park Commissioners are making use of this service to decorate and enhance the beauty of public parks and buildings? If results attained at San Diego are any indication, this service, if made known, will be reflected in greatly improved good will as well as increased use of power.

Security Issues Under S.E.C.

UNDER the operation of the securities act passed at the last session of Congress the amount of information that has to be filed in connection with proposed corporate financing assumes the proportions of a good-sized book. A case in point is the prospectus of the Commonwealth Edison Company's recent $29,500,000 bond issue, a volume of 69 pages of unusual size, 8½ by 13 inches. Half of this space is devoted to detailed financial statistics and explanatory notes regarding the company and its subsidiaries. These cover the company's investments and advances, fully listed; income and expense accounts and balance sheets, including those of subsidiaries, for each of the past three years, particulars as to surplus, and other data. Introducing and supporting this mass of financial information there are 33 pages of explanatory matter and two large map inserts. This section of the book includes a description of the business and property of the company and of the principal operating companies in which it has investments, a summary of contracts for coal and for the interchange or purchase of energy, an outline of a pending rate case and pending litigation and a discussion of the effects on the company of pending state and national legislation. This mechanism seems ponderous, but it does show up the solid strength behind sound utility issues and maybe the laborious effort is worth the cost.

Socialism in Action

WHAT happens in Socialist politics is well illustrated in strike-ridden Milwaukee. The City Council made a complete surrender to rioters when they raised bedlam each night in the district near the A. J. Lindeman & Hoverson plant. The Council ordered the police to close the plant until the strike was settled. This amounts to a declaration that in this city the public is unable to defend itself and that business enterprises will be closed by the police if sufficient disturbance can be staged at their doors. This is not an atmosphere conducive to business development or the growth of civic pride.

Smith Challenges LaGuardia's Claims

In address before Bronx Chamber of Commerce Consolidated Gas president declares proposed municipal plant would operate at deficit — Court blocks city's move for vote

Addressing a meeting of the Bronx Chamber of Commerce on September 30, Frank W. Smith, president of Consolidated Gas Company and the New York Edison Company, Inc., declared that the proposed municipal electric plant on any showing of figures yet made by its advocates would operate at a deficit. That deficit, he said, would have to be made up by the taxpayers, because there was no other place for the money to come from.

"The figures on which the Mayor made his promise about rates are based, it appears, on an estimate of his engineers that use of electricity in the selected area to be served by the municipal plant would double if these low rates were put into effect. . . . Now, we admit, in fact, we say just as strongly as we know how, that our residential rates could be reduced 38 per cent, or approximately to the levels the Mayor is talking about for the municipal plant, if the present consumption were doubled. But we know that the present consumption would not double immediately if rates were reduced 38 or 40 per cent. We know consumption would not double for a long, long time. In New York City the average use of electricity for residential customers has increased only about 40 per cent in the last fifteen years.

Equity of conditions does not exist

Discussing the plant as a yardstick, Mr. Smith said: "The municipal plant is to be built on city-owned land. There is no provision in the cost estimates for a purchase price for that land or for rental of it. Our companies have to buy their real estate or rent it and the city receives a large revenue from our real estate taxes. If the municipal plant is to pay rent to the city for the land, the cost estimates are incomplete, and therefore the results obtained are incorrect and misleading. If it escapes this charge, it will have that definite advantage over our business, and therefore the yardstick is only rubber.

"In the cost estimates for the municipal plant there is an allowance of 15 cents from each dollar of estimated revenue which is supposed to go to the city in lieu of taxes—to be a compensation, or make-weight for whatever loss of taxes paid by our companies would result from the establishment of this competing plant. Last year Consolidated Gas Company and its affiliated companies paid taxes amounting to 17.98 cents out of each dollar of revenues from sales of their service. Taxes have gone up since then and the best estimate we can make for the current year is that taxes will take from 22 to 23 cents out of each dollar we receive for selling our service. Again the yardstick proves to be rubber.

"The proposed municipal plant, according to the prospectus for it, would supply only alternating current. . . . We estimate that it would cost around $13,000,000 to convert the direct-current equipment in the selected area to alternating-current equipment, even if the municipal plant obtained only half of the customers in that area. Yet the estimates on which the announced low rates for the municipal plant are based contain only an item of two million dollars for such changeover of equipment.

Court restrains city

Supreme Court Justice Edward S. Dore handed down a decision requiring the Board of Elections to remove from the ballot the proposition to erect the plant and restraining the city officials from spending municipal funds on the proposed referendum. The suit was brought for the Consolidated Gas system by Edward J. Tierney, assistant treasurer of the New York Edison Company, as a taxpayer. The city appealed to the Appellate Division from Justice Dore's decision, but because three of its members felt themselves disqualified to pass upon the merits of the case, the hearing on the city's appeal has been deferred.

Utilities Open Court Test on Holding Company Act

At Baltimore hearings John W. Davis denounces law as a peril to all industry — Brief lists flaws — Utility board appointed to aid S.E.C.

The first important suit to test the constitutionality of the Wheeler-Rayburn Public Utility Act of 1935 was begun in the United States District Court at Baltimore on September 27 and briefs of the petitioners in the case were filed with the court the following week. A request for dismissal of the suit was made on September 27 by John J. Burns, counsel for the Securities and Exchange Commission, who contended that the suit is premature, and also argued that the government had not sufficient time to investigate the case. He charged that the suit was "an attempt to get an advisory opinion for the Edison Electric Institute on one of the most important pieces of legislation passed by Congress."

The court's final hearing in the case was held on September 28, when John W. Davis, counsel for the institute, said that if the law were upheld by the courts it would establish the power of Congress to control every business in the country. Mr. Davis represents an intervening party in connection with a proceeding brought by the trustees of the American States Public Service Company in the Federal District Court in Baltimore under Section 77B of the Bankruptcy Law.

Judge William C. Coleman, presiding at the hearing, was warned by Thomas G. Corcoran of the Attorney-General's office and Mr. Burns that if the Utilities Act were held invalid because of the delegation of postal powers it would follow collaterally that the Securities and Exchange Act of 1934 also would be invalid for the same reason. Mr. Corcoran also warned that while the S.E.C. would take the position that an adverse decision was not binding upon it, such a ruling could tie the hands of the commission from beginning administration of the Utility Act. Pointing out that the Edison Electric Institute was behind the litigation, he said that on the ground of the advisory opinion the whole industry might refuse to file notices of intention to register with the S.E.C. This was denied by Mr. Davis, who upheld the constitutionality of the Securities Act. Mr. Davis denied the public utility holding company, "face to face with the federal power," is any different from any other corporate holding company, investment trust or other corporate enterprise.

"Take this act," he said, "and insert in place of them 'textiles' or 'manufacturing' or 'foodstuffs' holding companies and you would not have subtracted one thing from every virtue it has as an exercise of federal power."

The brief filed with the court by Mr. Davis set forth five main points on which the act is attacked: (1) The business of the trustees, the debtor and its subsidiaries is not interstate commerce or subject to Congressional regulation. (2) The act attempts to regulate all the activities of registered holding companies, whether intrastate or interstate, without distinction between the two. Such a statute exceeds the power of Congress and is wholly void. (3) The act does not seek legitimate ends and, by its arbitrary, unreasonable and capricious terms, would deprive the trustees, the debtor and its subsidiaries of liberty and property without due process of law. (4) The act is unconstitutional because it delegates to the Securities and Exchange Commission, without establishing adequate and intelligent standards to guide and assist its discretion, the legislative power of determining what the law shall be and when and to whom it shall apply. (5) The act cannot be sustained on the theory that the use of the mails and of the instrumentalities of interstate commerce are mere privileges which Congress may condition or withdraw at will.

The government is expected to present its formal answer in the near future.

The appointment was made known on October 3 of a working committee of officials of public utility companies to cooperate with the Securities and Exhange Commission in the drafting of rules and regulations for the Administration of the Public Utility Act. The naming of the committee followed the meeting in Washington on September 25 of the commission and representative utility executives. Herbert C. Freeman, vice-president and comptroller of the North American Company, is chairman of the new committee, the other members being Samuel W. Murphy, vice-president Electric Bond & Share Company; J. M. Burchill, vice-president American Gas & Electric Company; Randall J. LeBoeuf, Jr., representing the American Gas Association, and Justin R. Whiting, general counsel Commonwealth & Southern Corporation.

S.E.C. issues rules

As ELECTRICAL WORLD goes to press, announcement is made that the Securities and Exchange Commission has issued the requirements which holding companies and subsidiaries must meet if they file preliminary regulations or if they seek exemption from registration. December 1 was set as the deadline for the filing of the preliminary registration form. The Federal Power Commission, meanwhile, was issuing its first regulations under the sections of the act which it administers.

Associated System Extends Holdings

Former National Electric Power properties become links in regional system to span Atlantic seaboard.

Control of Eastern Shore Public Service Company and Virginia Public Service Company through acquisition of their entire outstanding common capital stocks from the Chase National Bank of the city of New York has been announced by the Associated Gas & Electric System. The two companies serve substantial parts of Delaware, Maryland and Virginia. Control of these two units has been held by the Chase National Bank for nearly three years, having been acquired by the bank in partial satisfaction of the indebtedness to the bank for which they had been held as collateral.

Previously, in the summer of 1934. Associated had acquired from the Chase Bank securities which represented virtual control of Municipal Service Company, which owns groups of properties in southeastern and northwestern Pennsylvania, adjacent to the system's important holdings in that state and southern New York.

The present transaction marks the third important acquisition in a little more than a year, as Associated has also acquired the voting trust certificates for the entire capital stock of Penn Southern Power Company, the subsidiaries of which are: Penn Central Light & Power Company, Tide Water Power Company, Florida Power Corporation and Georgia Power & Light Company.

These various properties, of which the gross revenue as reported for 1934 amounted to nearly $23,000,000 and which serve about 250,000 electric customers, were formerly held by the National Electric Power Company, which prior to going into receivership was a subsidiary of the Middle West Utilities Company. They are close or contiguous to other holdings of Associated and were acquired in line with the program to fill in gaps between its principal properties, so far as possible, to concentrate its holdings along the Atlantic seaboard and to integrate the principal properties into a regional group.

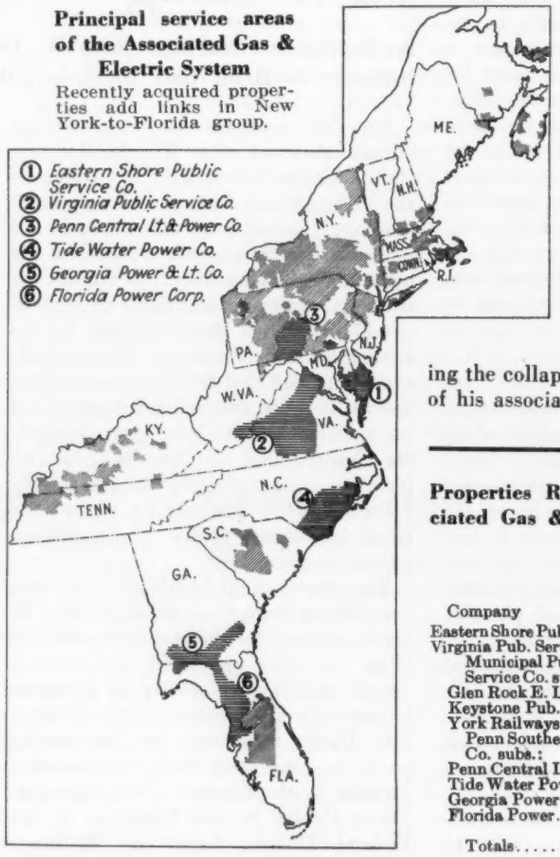
In connection with this expansion of its holdings Associated announces its intention to comply fully with the letter and spirit of the Wheeler-Rayburn act, now that this has become a law, although it had vigorously opposed its passage. Interstate operations are not to be discontinued, but on the contrary plans are under way to construct additional interstate lines in furtherance of the program of more complete integration and interconnection.

Continuity of management of the properties that were formerly in the National Electric Power Company group is indicated by the announcement that Harry Reid has become associated with Associated Gas & Electric in the operating management of the system under J. I. Mange, president. With Mr. Reid comes his entire organization, known as Harry Reid & Company, Inc.

In 1927 Mr. Reid became president of National Electric Power, one of the holding company units in the Insull utility system. Following the collapse of the later, he and some of his associates formed the organization

Principal service areas of the Associated Gas & Electric System

Recently acquired properties add links in New York-to-Florida group.



Properties Recently Acquired by Associated Gas & Electric System Statistics for 1934

Company	Operating Revenue	Electric Customers	Capacity Kw.
Eastern Shore Pub. Serv.	$2,161,552	30,010	22,000
Virginia Pub. Serv. Co.	7,008,709	73,462	88,251
Municipal Public Service Co. subs.:			
Glen Rock E. L. & P.	160,037	2,990	.....
Keystone Pub. Serv.	1,262,923	14,032	14,148
York Railways	2,443,754	26,806	7,000
Penn Southern Power Co. subs.:			
Penn Central Lt. & P.	4,853,780	57,743	80,620
Tide Water Power	1,639,900	14,982	13,150
Georgia Power & Lt.	823,172	8,354	4,430
Florida Power	2,381,088	23,008	58,518
Totals	$22,734,915	251,387	288,117

of utility experts and consultants which has now been taken over by Associated.

The announcement was also made that H. C. Hopson, former vice-president, has resigned as officer and director of all units in the Associated System, but still retains his interest. Reports that Mr. Reid would assume a dominating position, replace Mr. Hopson and become financial head of the system were declared to be without foundation.

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Electrical Equipment Group Meets in Chicago

Air conditioning was the special topic for attention at the meeting of the electrical equipment committee of the Edison Electric Institute under the chairmanship of W. F. Sims at Chicago October 7 and 8. The effects of air conditioning load on distribution systems and standards of service as they may influence system and equipment design and experience with present installations of air-conditioning apparatus were the matters discussed of most immediate interest to the system engineers.

Modernization of systems and stations, service-entrance cable developments, energy diversion, starting currents for fractional-horsepower motors, standards for static condensers, insulation testing and other subjects were covered in the two-day meeting. In the field of system engineering new engineering possibilities for economy and simplification developed by the pressure of the times were interestedly discussed.

Manufacturers Optimistic Over Business Outlook

More than 600 electrical manufacturers attended the meeting of the National Electrical Manufacturers Association in Chicago this week. The general report was favorable to increased business and business development programs were featured. President Frank C. Jones pointed out that a by-product of the persecution of the utilities by the Administration was the making of the public electrically conscious. He pointed to power output and to industrial modernization as indicators of an upturn in business. In his opinion recent social security legislation will create an enormous demand for labor-saving machinery. He predicted a steady upturn in capital goods industries and thought that by 1938 the electrical industry would have the greatest volume of business in its history.

At the general meeting the major topic discussed was business development. The business development committee, through C. E. Swartzbaugh, told of the work done and the plans for next year. Topics and projects include the promotion of adequate wiring and other sales promotion activities that tie in with R.E.A., F.H.A., E.H.F.A. and joint industry committees. The cordial support of all sections was solicited for this business development program. During the year, despite the collapse of NRA, officers reported that N.E.M.A. activities had been carried on and improved. Standardization work, studies on legislation, revision of organization, uniform accounting, statistics and other services have been improved and will be continued. Talks with individual manufacturers brought out that business has improved greatly this year and that nearly all are budgeting increased sales for next year. Slow commitments by some large buying groups are expected to add peak demands on production and delivery of some products and a large number have added to their inventories to help meet this situation.

The several sections of N.E.M.A. met during the week and one large meeting of the policy division was held Wednesday night. Considerable comment was heard on the recent Administration suggestion of developing trade practice agreements with the Federal Trade Commission, as well as the current investigation of some wire and cable companies. The meeting was well attended and the general opinion was quite optimistic over future developments in business and in N.E.M.A. organization. The annual report of the board of governors was presented and an outline of projects for the coming year. These documents cover a multitude of actual and proposed co-operative aids conducted under N.E.M.A. auspices.

UTILITY LEADERS CONFER WITH S.E.C.

Wide World

Representatives of the leading utility companies met recently with the members of the Securities and Exchange Commission to discuss plans for administering the new holding company act

Left to right seated—Sam W. Murphy, Electric Bond & Share Company; James F. Fogarty, president North American Company; James M. Landis, chairman S.E.C., and Judge Robert E. Healy, member S.E.C. Standing—Randall J. LeBoeuf, Jr., American Gas Association; Daniel C. Green, president Middle West Utilities Company; William J. Hagenah, Standard Gas & Electric Company; George C. Mathews, member S.E.C.; W. Alton Jones, vice-president Cities Service Company; Wendell L. Willkie, president Commonwealth & Southern Corporation; Frank D. Comerford, director New England Power Association; Garfield Scott, United Gas Improvement Company; H. H. Porter, American Water Works & Electric Company, and Frederick S. Burroughs, vice-president of the Associated Gas & Electric Securities Company.

Roosevelt Defends Public Works Program

Standing on a platform perched high above the Colorado River, President Roosevelt dedicated Boulder Dam on September 30 as a "splendid symbol" of employment-providing public works which he said have already given the necessary recovery spur to private industry while increasing the value of the nation's resources. He made power development a secondary topic in the speech.

The President said in part: "Labor makes wealth. The use of materials makes wealth. To employ workers and materials when private employment has failed is to translate into great national possessions the energy that otherwise would be wasted. Boulder Dam is a splendid symbol. The mighty waters of the Colorado were running unused to the sea. Today we translate them into a great national possession. . . . These great government power projects will affect not only the development of agriculture and industry and mining in this section they serve, but they will also prove useful yardsticks to measure the cost of power throughout the United States. It is my belief that the government should proceed to lay down the first yardsticks from this great power plant in the form of a state power line, assisted in its financing by the government, and tapping the wonderful natural resources of southern Nevada. Doubtless the same policy of financial assistance to state authorities can be followed in the development of Nevada's sister state, Arizona, on the other side of the river. . . .

"It is a simple fact that government spending is already beginning to show definite signs of its effect on consumer spending; that the putting of people to work by the government has put other people to work through private employment, and that in two years and a half we have come to the point where private industry must bear the principal responsibility of keeping the processes of greater employment moving forward with accelerated speed.

"The people of the United States are proud of Boulder Dam. . . . Today marks the official completion and dedication of Boulder Dam, the first of four great governmental regional units. This is an engineering victory of the first order—another great achievement of American resourcefulness, skill and determination. . . ."

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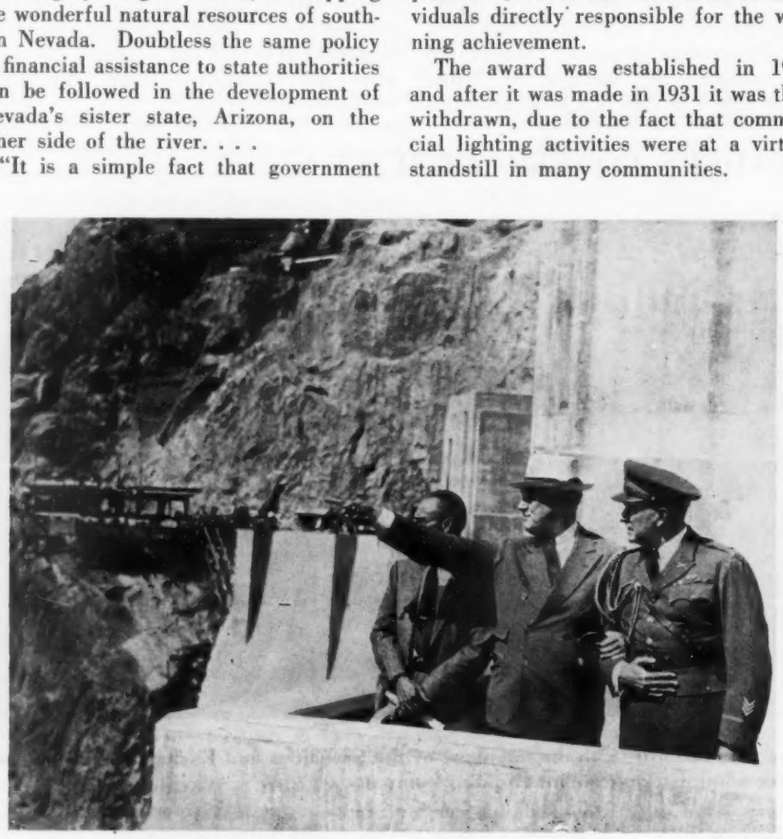
Curtis Award Reinstated

Darwin Curtis, recently elected president of Curtis Lighting, Inc., has announced that the Augustus D. Curtis Award will be reinstated by Edison Electric Institute for competition closing April 1, 1936. The winner will be announced at the next E. E. I. convention. The Curtis Award is for outstanding achievement by a utility company in the field of commercial lighting. The citation goes to the company and the cash prize of $250 to the individual or individuals directly responsible for the winning achievement.

The award was established in 1930 and after it was made in 1931 it was then withdrawn, due to the fact that commercial lighting activities were at a virtual standstill in many communities.



Wide World

From Lookout Point, on the Arizona side, President Roosevelt points out the sights of Boulder Dam to Colonel Watson, his military aide. Also with the President is Walker Young, engineer in charge of construction.

COMING MEETINGS

National Association of Railroad and Utilities Commissioners—Annual convention, Nashville, Tenn., October 15-18. John E. Benton, general solicitor, 806 Earle Building, Washington, D. C.

National Electrical Wholesalers' Association—Annual convention, Chicago, Ill., October 14-18. E. Donald Tolles, managing director, 165 Broadway, New York.

National Safety Council—Annual safety congress and exposition, Louisville, Ky., October 14-18.

American Institute of Electrical Engineers—Great Lakes District meeting, Purdue University, West Lafayette, Ind., October 24-25. H. H. Henline, national secretary, 33 West 39th Street, New York.

Indiana Electric Association—Purdue University, Lafayette, Ind., November 7-8. Tom C. Polk, secretary, 609 Traction Terminal Building, Indianapolis, Ind.

New York State Executives Discuss Politics and Sales

A program, equally balanced between discussion of industry problems arising from current legislation and the development of sales programs under present conditions, was presented at a convention of the Empire State Gas and Electric Association at Rye, N. Y., on October 4-5.

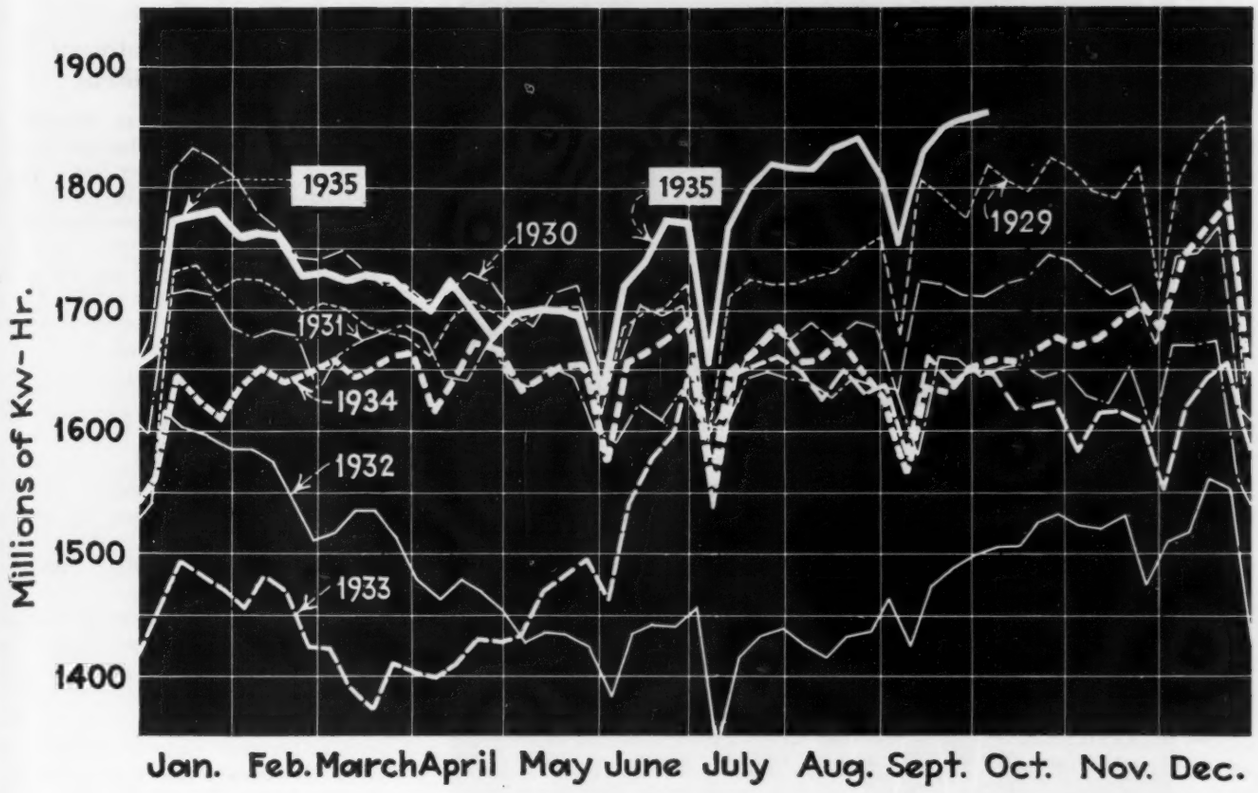
A discussion of activities of the Edison Electric Institute in combating excessive regulatory legislation was presented by Bernard F. Weadock. A program designed to combat excessive governmental regulation and control on all fronts has been instigated by the institute. Mr. Weadock discussed the execution of the program and the difficulties being met. He pointed out that this industry has its job ahead and that the task to come will be bigger and better than any before. "Prepare to meet it," he urged.

Trends in the design of modern homes were outlined and discussed by T. K. Quinn, vice-president of the General Electric Company. Mr. Quinn stressed the importance of electrical appliances in the modern American home and urged utility executives to build model homes in the communities they serve.

An able discussion of sales planning and selling under present conditions was presented by Alvin E. Dodd of American Management Corporation. Mr. Dodd urged the application of the three fundamental steps of merchandising, market analysis, pricing and positive selling attack, to the sale of electricity and gas. "Whoever you sell and whatever you sell, you need knowledge about your customers," Mr. Dodd declared. He urged the use of meter readers to secure merchandising knowledge about customers.

Ernest R. Acker was elected president to succeed Clifford E. Paige. Charles E. Bennett was elected vice-president and Walter C. Phelps was re-elected treasurer.

Output Breaks All Previous Records



All former records were broken by the central-station output, during the week ended October 5, of 1,863,483,000 kw.-hr., and the production curve continues on its upward trend. The previous maximum as reported by the Edison Electric Institute was 1,860,021,000 kw.-hr. in the week before Christmas of 1929. The new figures surpass those of the corresponding period of that year by 2.4 per cent. The wide margin over 1934 continues. It has been greater than 10 per cent during each of the past seven weeks and now stands at 12.3 per cent.

All sections of the country are participating in the forward movement, though in differing degree. The greatest gain over 1934 is still in the Mountain States, where it has been above 30 per cent throughout the past three months; the latest figure is 35.7 per cent. In the Central industrial area it has been gradually rising from 6.3 per cent, early in July, to 17.3 per cent. New England is up 10.1 per cent, although there has been a shrinkage from the 16.8 per cent of mid-September. Other regions ranged down to 6.6 per cent.

Weekly Output, Millions of Kw.-Hr.

1935		1934		1933	
Oct. 5	1,863	Oct. 6	1,659	Oct. 7	1,646
Sept. 28	1,857	Sept. 29	1,649	Sept. 30	1,653
Sept. 21	1,852	Sept. 22	1,631	Sept. 23	1,639
Sept. 14	1,828	Sept. 15	1,634	Sept. 16	1,663
Sept. 7	1,752	Sept. 8	1,565	Sept. 9	1,583
Aug. 31	1,810	Sept. 1	1,627	Sept. 2	1,637

Per Cent Change from Previous Year

Region	Week ended Oct. 5	Sept. 28	Sept. 21
New England	+10.1	+11.6	+16.8
Middle Atlantic	+ 7.5	+ 5.6	+ 6.3
Central Industrial	+17.3	+15.7	+15.8
West Central	+ 6.6	+12.9	+10.2
Southern States	+ 8.6	+10.5	+16.9
Rocky Mountain	+35.7	+44.8	+48.0
Pacific Coast	+ 7.4	+11.6	+ 8.6
United States	+12.3	+12.6	+13.5

August Output at New Level

More energy was generated in public utility plants during August than in the like month of any other year, the increase over August, 1934, amounting to 11 per cent. Production was 8,586,000,000 kw.-hr., according to the U. S. Geological Survey. The increase of 2.6 per cent over the revised figure for July, 8,372,000,000 kw.-hr., is normal, but the fact that the output was considerably larger than that of last January, 8,349,000,000 kw.-hr., deserves attention. Production in midsummer is usually smaller than in winter, although there have been several exceptions to this rule during the past few years.

Water-power contributed 39 per cent of the total output, but the output from this source was 7 per cent less than in July, indicating the beginning of the seasonal decrease due to diminished stream flow. Regional changes in total production are shown in the accompanying table.

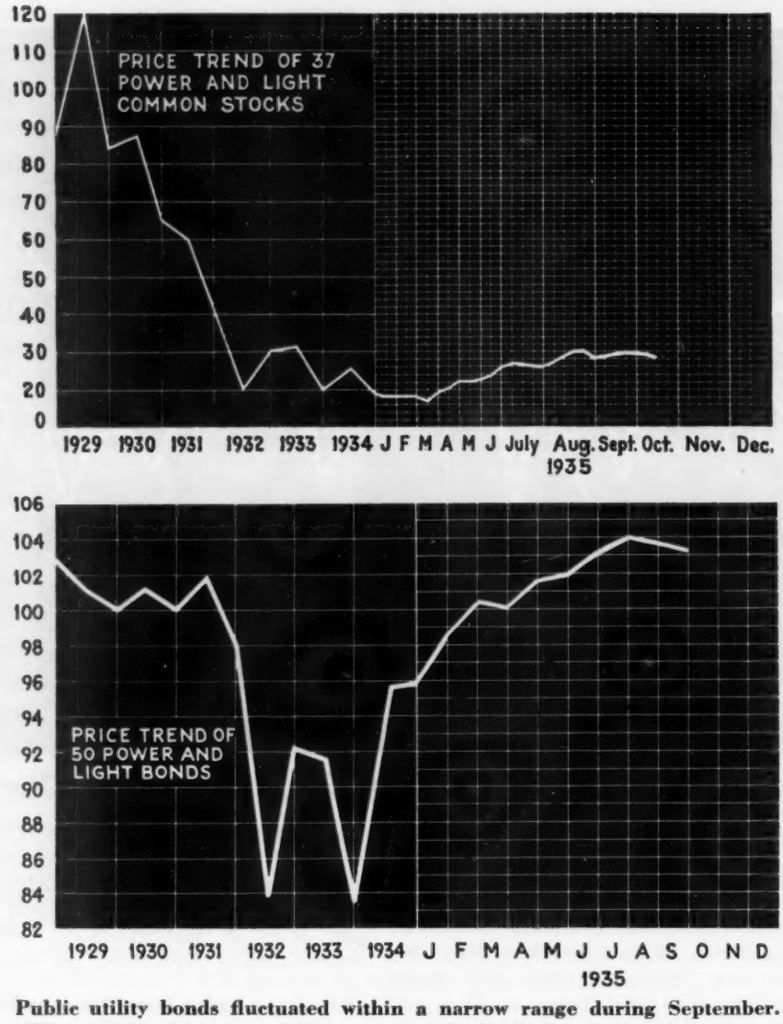
Regional Gains Over 1934, per Cent

	May	June	July	Aug.
United States	+ 4	+ 5	+10	+11
New England	+ 3	+ 8	+10	+10
Middle Atlantic	+ 3	+ 4	+10	+ 8
East No. Central	+ 3	— 3	+ 7	+12
West No. Central	+15	+18	+15	+12
South Atlantic	+ 7	0	+ 8	+18
East So. Central	+ 4	+28	+21	+ 3
West So. Central	+ 5	0	+ 6	+ 5
Mountain	+15	+35	+36	+42
Pacific	— 2	+ 7	+ 6	+ 9

Commission to Investigate Savannah River Project

President Roosevelt has appointed a commission of three engineers to investigate the feasibility of constructing a $17,500,000 dam on the Savannah River about 17 miles above Augusta, Ga., as a combined flood-control, navigation and power project. The commission consists of Col. Earl Brown, Corps of Engineers; Roger B. McWhorter, chief engineer of the Federal Power Commission, and Sherman W. Woodward of the National Resources Board, a former professor of engineering at Iowa State University and consultant to T.V.A. The first meeting of the commission will be held in the near future.

Utility Securities Slightly Lower



Public utility bonds fluctuated within a narrow range during September. "Electrical World" index, 103.4; August, 103.7. Utility stock prices showed slight recessions. "Electrical World" index this week, 28.2; last week, 28.6.

Standard Gas & Electric Files Bankruptcy Petition

Unable to refund $24,640,000 of gold note issues October 1, the Standard Gas & Electric Company filed a petition on September 27 in the United States District Court in Wilmington, Del., for reorganization under Section 77B of the National Bankruptcy Act.

With this petition the company filed a copy of its plan for the extension to October 1, 1940, of the maturity of these notes, stating its inability, although solvent, to meet these debts as they mature, and reciting that the holders of the majority in amount of the notes due agreed to the extension plan. The court authorized the company to continue the solicitation of the deposit of notes under the plan.

At the same time note holders filed a petition asking for reorganization, before Federal Judge Philip L. Sullivan of Chicago. The petition stated that the present "fair value" of the company does not exceed $50,000,000, although the book value set by the company is $310,752,452. It was also maintained that holders of more than $11,000,000 in notes have not consented to the proposal.

Founded in 1910, Standard Gas owns properties in twenty states and Mexico, serving communities with an estimated population of 6,000,000 persons. It is controlled by the Standard Power & Light Company and in turn by the United States Electric Power Company and H. M. Byllesby & Company.

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P.W.A. Loans Restrained

Additional temporary orders restraining P.W.A. from loaning money for municipal utility plants were granted last week by Chief Justice Wheat of the District of Columbia Supreme Court. The actions were brought by the Texas Utilities Company and the Gulf States Utilities Company and affected P.W.A. loans to the Texas cities of Post, Littlefield, Plainview and Huntsville.

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Santee-Cooper Allotment Approved by President

President Roosevelt has approved an allotment of $500,000 for preliminary work on the Santee-Cooper hydro-electric and navigation project in South Carolina. This sum, which is to be expended within a year, consists of a grant of $225,000, representing 45 per cent of the total, and $275,000 loan. The Santee-Cooper project is estimated to require $37,500,000 for completion.

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Awards Contracts for Boulder Dam Line

Clearing the way for the launching of work on the 237-mile power transmission line from Boulder Dam to the pumping plants of the Colorado River Aqueduct, the board of directors of the Metropolitan Water District has awarded contracts totaling $1,561,705 for construction and materials, subject to the approval of the Reconstruction Finance Corporation.

Total cost of the 230,000-volt line, which ultimately will carry 36 per cent of all the electrical energy generated at Boulder Dam, will be $2,266,204. Aluminum conductors will be used, except for 10 miles of the length. Bids received for aluminum conductor were $187,394 to $257,162 lower than comparable bids on copper conductor, it is stated.

The following contracts were awarded:

1. To the Aluminum Company of America for aluminum conductor and appurtenances, $614,316.98.
2. To the Anaconda Wire & Cable Company for the 10 miles of copper conductor which will be used, $37,246.71.
3. To Fritz Ziebarth for construction of the 237-mile line, $407,246.71.
4. To the Pacific Coast Steel Company for furnishing steel towers, $402,300.36.

The awards were made on the basis of a second set of bids, received September 25, after rejection of those opened August 20. It was pointed out by General Manager Weymouth that the aluminum prices received on September 25 were $11,916 lower than those received in August. Construction will require about two years. Preliminary work is to be started at once.

New York Metal Prices

	Sept. 25, 1935 Cents per Pound	Oct. 8, 1935 Cents per Pound
Copper electrolytic	9.00*	9.25*
Lead, Am. S. & R. Price	4.50	4.60
Antimony	14.00	14.75
Nickel ingot	35.00	35.00
Zinc spot	5.124	5.225
Tin Straits	48.875	51.00
Aluminum, 99 per cent	19—21	19—21

*Delivered Connecticut Valley.

MANUFACTURING AND MARKETS

Favorable Business Items

Copper higher abroad, rumored higher here.
Machine toolers buy electrical equipment.
Strike settlement opens coal trade buying.
Rural electrification stimulated by E.H.F.A.
Supply goods continue brisk improvement.

Unfavorable Business Items

Building trade still slow to accelerate.
War actuality leaves stocks hesitant.
Small electrical business failures increase.
Embargoes put damper on exports.
Utilities still holding off large commitments.

Brooklyn Is Going After Range Business

A sign of the times is the active development of the electric range business in Brooklyn. A meeting sponsored by the Brooklyn Edison Company called together some 300 retail dealers and most of the range manufacturers on September 30 to announce the program.

Speakers who presented the subject were John C. Parker, Charles L. Harold, Edward L. Holmberg and Pierre L. Miles. Mr. Parker pointed out that the new rates in Brooklyn opened up a range prospect list of 60,000 customers, of whom some 47,000 lived in one- and two-family houses. While not merchandising itself, the Brooklyn Edison Company is going to give every possible help to dealers to get ranges sold. These aids include direct mail, newspaper advertising, employee bonus payments for sales leads, a range sales school, company home economists and demonstrators to aid dealers and other tangible supports.

This meeting was unusual in that it brought all manufacturers and dealers together with the utility to organize a joint as well as an individual effort to sell ranges. Mr. Miles stressed the sales points to make in successful range selling and Mr. Harold said that the experience of others in range selling would be followed and placed at the disposal of all retailers. Brooklyn is going to sell ranges if the spirit of confidence shown at this meeting is taken as evidence.

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New York Contractors Organize Code Committee

Local Code Committee for the Electrical Contracting Industry of New York, Inc., New York City, has been chartered by the Secretary of State as a membership corporation without capital stock. Its objects and purposes, as stated in its certificate of incorporation, are: (1) To effectuate a voluntary local code of fair competition for the electrical contracting industry founded on the principles of the recent National Code of Fair Competition for the Electrical Contracting Industry and the experience gained thereby so that the interests of labor, the public and employer can best be served and protected by the elimination of unfair competitive trade practices; (b) to prevent a return to those unfair business practices, the effect of which is to lower the standard of wage scales and working conditions of employees and promote ruinous business practices on the part of employers, and to make agreements between employees and employers to carry out such purposes.

Charles L. Eidlitz, Frederick W. Lord, Cecil M. Munoz, Walter Knapp, Harold Storey are the incorporators. Isidor H. Taylor is attorney for the new association.

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August Refrigerator Sales

Domestic sales of electrical household refrigerators in August totaled 100,247 units, valued at $7,760,601, according to figures supplied by fourteen producers and released recently through the National Electrical Manufacturers Association. The figure is below the $11,020,929 total for July, but compares favorably with August, 1934, when sales volume reached only $5,581,380. For the eight months of this year sales of 1,246,478 units with a total value of $96,134,678 have been made. This compares with 1,012,619 units valued at $85,097,595 sold in the corresponding period last year. In addition to domestic sales, the industry reports the shipment of more than 9,500 refrigerators to foreign markets last month.

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N.E.M.A. Charged With Unlawful Combination

Charging unlawful combination, conspiracy and agreement to restrain competition in the marketing of power cables and wire products, the Federal Trade Commission has issued a complaint against the National Electrical Manufacturers Association, its officers and sixteen member companies and fixed November 1 as the date of a hearing for their defense against a cease and desist order.

The complaint charges that the respondents conferred together, systematically exchanged price information, and agreed to quote, sell and deliver their goods according to identical prices and sales conditions. It is further claimed

HENRY FORD AND GERARD SWOPE TALK IT OVER

Henry Ford, Edsel Ford and several Ford officials spent a day looking over the mammoth 110,000-kw. turbine now building for Ford's River Rouge generating station. It is the first large unit to operate at 1,200 lb. pressure and 900 deg. F. This turbine and some big G.E. electric furnaces are part of the Ford program of progressive modernization.

that they required jobbers to resell at uniform list prices, and adjusted prices to favor customers having heavy transportation costs at the expense of nearby buyers. Such actions and policies have deprived purchasers of power cable, transmission wire and other electrical apparatus of the advantages of normal competition that formerly existed, according to the commission, and has artificially enhanced prices. As a result, the complaint states, "the amounts so exacted from public utilities, whether publicly or privately owned, and from municipalities and the government as an incident to the transmission of electric light and power in some cases become a part of the permanent investment on which consumers of electricity are called upon to pay a continual return, or if publicly owned, at least sufficient to retire the investment in such utilities."

The sixteen companies named in the complaint are:

American Electrical Works, American Steel & Wire Company, Anaconda Wire & Cable Company, Bishop Wire & Cable Corporation, Boston Insulated Wire & Cable Company, Crescent Insulated Wire & Cable Company, General Cable Corporation, General Electric Company, Habirshaw Cable & Wire Corporation, National Electrical Products Corporation. The Okonite Company, Phelps-Dodge Copper Products Corporation, John A. Roebling's Sons Company, Simplex Wire & Cable Company, Triangle Conduit & Cable Company, United States Rubber Products Company.

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They're Buying Things in the West

From the far Western states embracing the Twelfth Federal Reserve District comes a report of a 35.9 per cent increase in wholesale trade in electrical supplies during August of this year over 1934, and an increase during the first eight months of 31.4 per cent. Retail sales of small electrical appliances by department stores during the month were 7.9 per cent higher in value, while heavy appliances —washers, ironers, refrigerators and others—were up 20.4 per cent. Interconnected companies in California generated 8.2 per cent more energy during August and 1.1 per cent more during the eight months than in the corresponding periods of 1934, according to an announcement made by the Pacific Gas & Electric Company.

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Allis-Chalmers Business

Business of the Allis-Chalmers Manufacturing Company during the third quarter of this year was as good as in the second quarter, when the company reported a profit, according to an announcement made last week by General Otto H. Falk, chairman of the company, after a meeting of the directors.

"Farm business has been particularly good and collections are excellent," General Falk said. "Utility buying is still very small, but the total business of the company is well ahead of a year ago."

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Electromaster Expands Plant

A new high record in electric range sales has necessitated a substantial expansion of the Electromaster plant in Detroit. The additional factory will be known as Electromaster Plant 2 and will give not only a 40 per cent increase in floor space but also provide greater shipping facilities.

"Electromaster's monthly sales curve has practically kept right on ascending since January 1, without any evidence at all of the seasonal slump that is generally experienced during July and August," said Gerald Hulett, Electromaster's vice-president, in announcing the increase in the company's production capacity.

General Electric Orders Increase 34 per Cent

Orders received by the General Electric Company for the third quarter of 1935 amounted to $54,400,819, compared with $40,458,901 for the third quarter of 1934, an increase of 34 per cent, President Gerard Swope announced this week.

Orders received for the nine months amounted to $158,943,765, compared with $132,613,543 for the nine months last year, an increase of 20 per cent.

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Three Additional Leagues

Certificates of approval have been authorized by the National Electrical Manufacturers Association committee on league finance for three additional leagues. They are the Electrical League of Milwaukee, Milwaukee, Wis.; Electrical League of Rhode Island, Providence, and the Electrical Association of Rochester, Inc., Rochester, N. Y.

Field Reports on Business

Special reports to ELECTRICAL WORLD indicate that the general business and industrial improvement that has been in progress for some time throughout the nation is being maintained.

NEW ENGLAND

An undercurrent of improvement features the New England electrical trade. While little important apparatus has been sold in the past fortnight, a substantial volume of scattered orders has been booked. Industrial inquiries and sales are picking up except in textiles. Machine tool motors are moving actively in the market, and wiring devices are showing more life. Utility outputs continue to push upward and commercial cooking is forging ahead steadily.

The Parker House, Boston, has purchased electric kitchen equipment totaling about 68 kw. and including two ranges, several broilers, toasters, fry kettles and related appliances, and the remodeling of the Copley Square Hotel has absorbed about 25 kw. in heavy-duty cooking devices. A 24-kw. bread baking oven has been bought by a large Boston market. Wholesalers report lengthening deliveries on various domestic appliances under the hollow-ware classification and have been ordering ahead against a heavy fall demand. In general, little carload business is being handled, but as industrial improvements pick up in number, wire and interior electrical supplies are likely to reflect considerable quickening in demand. Three New England central stations are studying programs for generating plant modernization, including new boiler equipment, and ultimate increases in capacity. There is some business in voltage regulators for distribution substations, northern New England having bought apparatus of this kind on a moderate scale of late.

The activity of motor car makers in the Middle West has been reflected in the New England machine tool field and in other necessary plants in the purchase of motor and control equipment for production service. Another bright spot is the movement of air-cooled transformers for industrial plant service, resulting from simplification of central station rate structures which enable more energy to be sold for lighting purposes in conjunction with power and heating applications.

The air-conditioning field has absorbed not a little electrical equipment in the New England area during the past summer and winter applications are likely to continue to interest both utility and manufacturing people. Industrial steam plant projects are lively and competitive power developments are pressing forward for decision in various quarters. Collections are holding up well in dealer circles, but are slightly off in industrial areas.

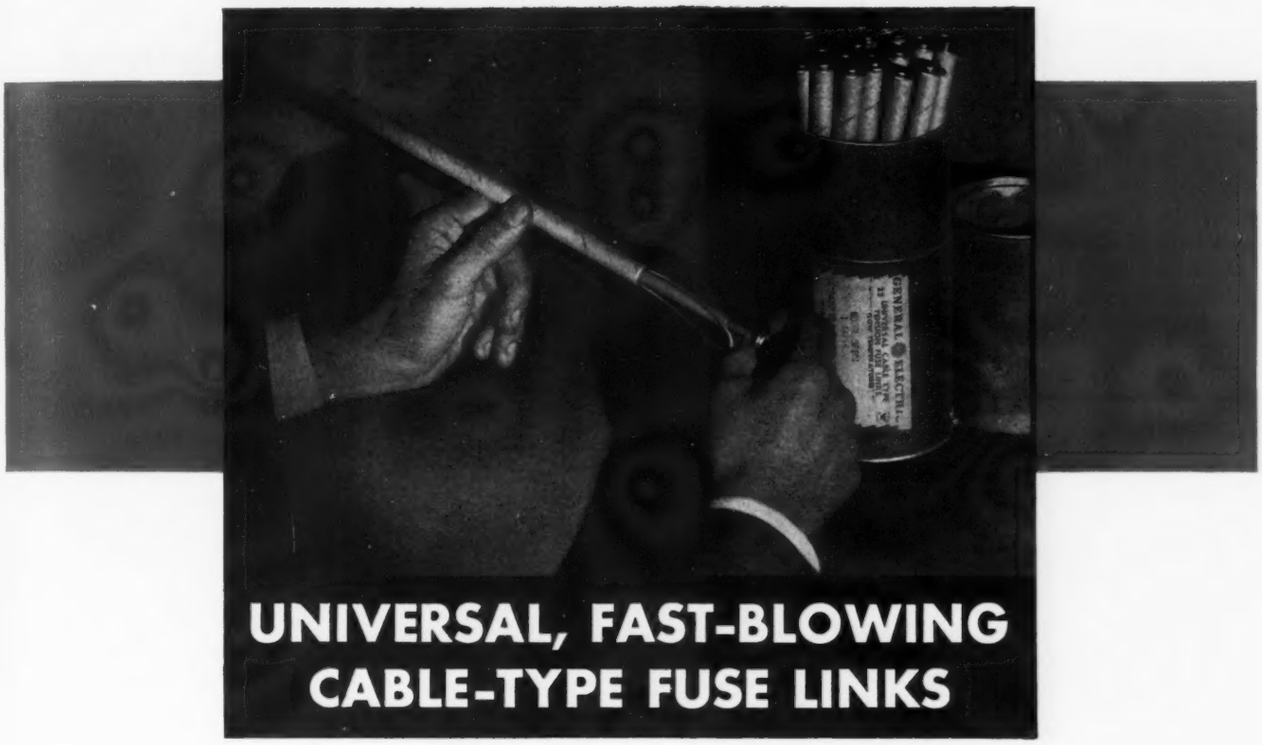
CHICAGO AREA

As regards business in large equipment the condition in the Chicago trade region is one of hopeful waiting and not of receipt of orders. However, there are in the offing several known requirements of major size that shortly will develop into signed contracts. In the meantime the large suppliers are contenting themselves with their shares of a $150,000 total order for a substation to be erected by an Illinois utility for service to a large industrial plant up in the northwest corner of the state.

The steady push of buying continues in comparatively small orders from industrial and commercial concerns busy with necessary rehabilitation. Devices for resale as built-in parts of factory and domestic tools and appliances are moving at a satisfactory rate. Figures released by the Electric Association of Chicago show 63 per cent of reporting manufacturers with increases of business from July to August this year, 83 per cent with increases of August this year over same month last year and 91 per cent with increases for total business in the first eight months this year as against same period last year. Reports from wholesalers of electrical materials follow the same trend.

Why it PAYS *to use*

G-E FAST-BLOWING Fuse Links



UNIVERSAL, FAST-BLOWING CABLE-TYPE FUSE LINKS

BECAUSE

with them, you can isolate faults to smaller areas. Their carefully designed time-current characteristics permit installation in series, with smaller time differentials.

BECAUSE

they reduce re-fusing costs—they prevent unnecessary interruptions in service. They are fast-blowing—in fact a faster fuse link would be impractical from an operating standpoint—yet they will not blow on temporary overloads or motor-starting currents.

Take advantage of the improved protection which these fuse links afford. Complete information is given in Bulletin GEA-1994A. To make it easy for you to select the proper size to give the best operating results, the bulletin includes co-ordinating charts and characteristic curves. Because they are based on tests at full rated voltage, these curves give total clearing time. General Electric Company, Schenectady, N. Y.

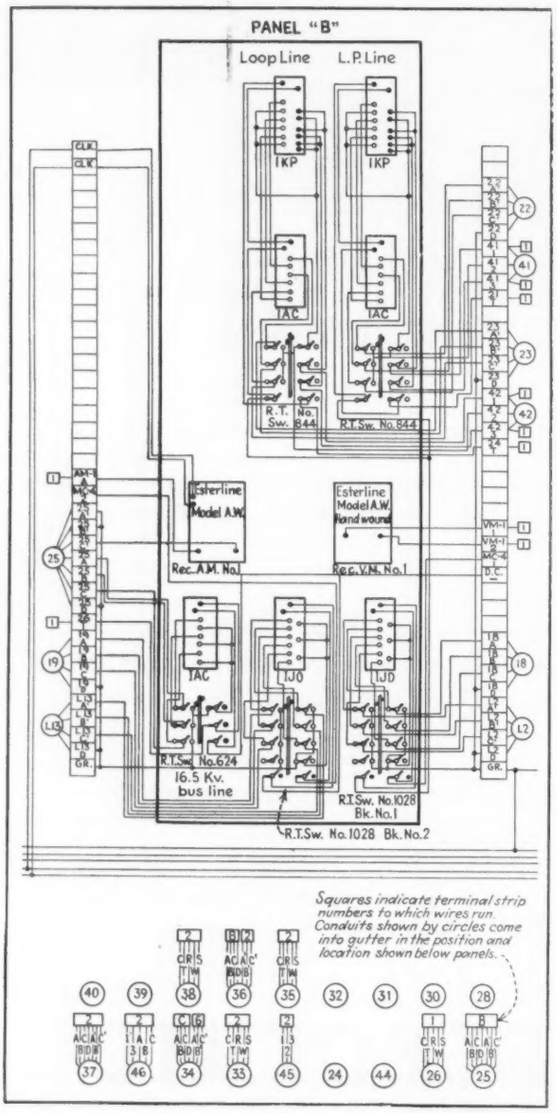
340-18

GENERAL ELECTRIC

New Nomenclature Simplifies Diagram

As an aid to the switchboard electrician in wiring up switchboard panels, the engineering department of the city of Pasadena, Calif., developed a new identification technique which eliminates the necessity of providing complete control diagrams on the switchboard blueprint.

Conduits carrying switchboard circuits are inserted below the panel wiring diagram and numbered for identification. Circuits in each conduit are connected diagrammatically to a small block, which represents the panel terminal strip to which circuits in that particular conduit are to be run. Conversely, each panel diagram includes a representation of the terminal strip for that panel, each division of which is identified by the letter or number of the lead or leads which terminate there. Alongside each terminal strip conduits are again represented by number and leads emanating from this conduit are connected by short lines to the proper division of the terminal strip. Every terminal strip division to which a connection is to be made is so indicated; circles represent conduits and squares other terminal strips, indicating that the leads run between panels. The method not only saves time in preparation of the diagram itself but eliminates confusion and delay in erecting the switchboard. The positive identification of all leads also tends to reduce errors and the expense incident in their correction.



Wiring diagram incorporates simplified method of wiring identification

A cross-index method of identifying and locating leads from the conduits to the switchboard has saved the time and expense in switchboard erection. Leads "A," "B," "C" and "D" are shown in the diagram as being carried in conduit 25 and terminating on terminal strip B. The wireman looks for terminal strip B on his switchboard diagram and finds the divisions of the terminal strip that are lettered "A," "B," "C" and "D" are the eighth, ninth, tenth and twelfth respectively and that each of these divisions is shown to be connected to conduit No. 25. Thus he connects the leads from that conduit to the appropriate sections of the panel terminal strip and the wiring is complete.

Catch Box Dried by Blower Heater

Catch-box (underground junction) drying on the Boston Edison Company's 115-230-volt direct current system has been speeded about fourfold by utilizing a 1,050-watt motor-driven air drier equipped by the distribution department with a rubber nozzle 12 in. long, 2 in. in diameter at the fan outlet and 1 in. outside at the delivery end. The outfit weighs about 15 lb., and is provided with 25 ft. of "Tirex" cable and a plug clip at the end for attachment to the circuit terminals. The converted device was a Hamilton-Beach unit. When drying catch boxes by exposure to sun the job has taken from four to five hours under the best conditions of weather and traffic. By the above method the work can be done by day or night in about an hour, the only limitation being moist weather.

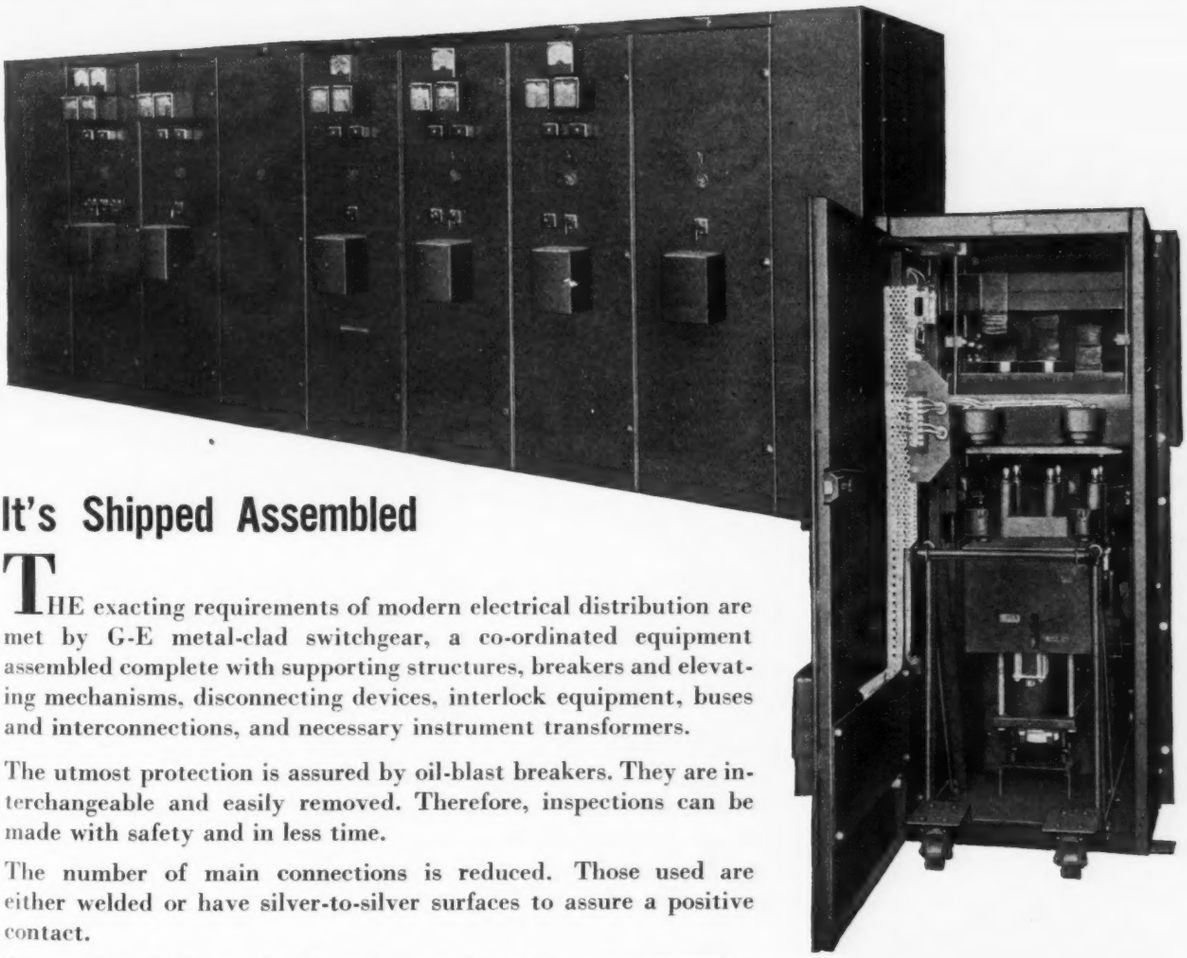
Diary Regulates Maintenance Work

By K. B. HUMPHREY
Sayreville, N. J.

Electricians having a large amount and variety of equipment to maintain should so arrange their work that it consists of more than merely repairing equipment that has gone wrong. Units should be maintained in such a

Modern Switchgear Is Metal-clad

REDUCES YOUR MAINTENANCE — AND IT'S SAFER



It's Shipped Assembled

THE exacting requirements of modern electrical distribution are met by G-E metal-clad switchgear, a co-ordinated equipment assembled complete with supporting structures, breakers and elevating mechanisms, disconnecting devices, interlock equipment, buses and interconnections, and necessary instrument transformers.

The utmost protection is assured by oil-blast breakers. They are interchangeable and easily removed. Therefore, inspections can be made with safety and in less time.

The number of main connections is reduced. Those used are either welded or have silver-to-silver surfaces to assure a positive contact.

Present-day G-E metal-clad switchgear has stronger construction because of its greatly reduced sizes: its lighter weight has reduced handling costs. Its application is not restricted. Specify this modern self-contained equipment for all new construction and when modernizing plants. Call the nearest G-E office, or General Electric Co., Schenectady, N. Y.

Breaker lowered on truck for removal and inspection

820-17

GENERAL ELECTRIC

way that serious breakdowns seldom occur.

In the larger plants work is laid out so that the maintenance crews go from one department to another according to a prearranged schedule. In smaller plants much less system is usually found. The electrician is generally allowed to follow his own inclinations. Breakdowns, therefore, depend to a large extent upon the man in charge.

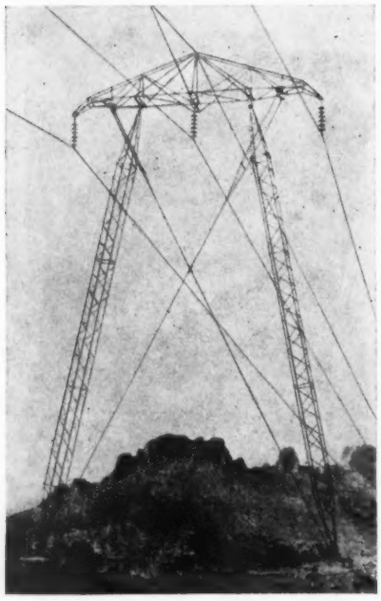
To keep a record of inspections and also to remind the electrician when one is necessary, a day-to-day diary is useful. Suppose, for instance, on April 1 when a certain motor was inspected and the starter oil box dropped, the contacts were found to be in such shape that there would be expected normally six more months of operation before another inspection would be necessary. If a diary is kept a notation is placed on the October 1 page stating that it was time to look at this starter. When this date arrives the electrician is reminded that the starter should be looked at. If new contacts are required or any other repairs are necessary a notation should be placed under the original reminder and a notation made six months ahead for another inspection.

In this way every piece of apparatus can be listed and a record obtained of its performance. Nothing is overlooked to the extent that an accident or failure is likely.

Records of all regular maintenance work, inspections, repairs and replacements should be kept in the same book. This book, not too small, should have at least a page for each day, and should be written up regularly at the end of the day.

Records of this type if carefully kept will form the basis upon which costs of replacements can be based. It also enables the electrician to lay out his work in an orderly manner so that there is plenty of time for everything.

Articulated Tower



Power for the Algerian State Railway is transmitted over 84 miles at 90,000 volts on articulated towers held vertical by the ground cable. According to René P. Chauvet, Morges, Switzerland, tests have proved that the tower resists loads due to broken conductors without permanent deformation

•

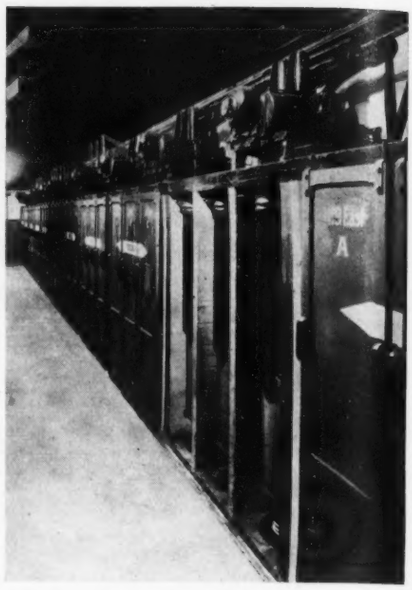
Breakers Modernized With Minimum Ado

By W. J. LANK
Potomac Electric Power Company, Washington, D. C.

Within the last nine years the load served by the Potomac Electric Power Company in Washington, D. C., has more than doubled. Additional generating and tie-line capacity necessary to meet this rapid load growth has likewise increased proportionally. While the new stations could readily be provided with protective equipment of ample rating, the older stations with existing breakers were of particular concern because of the increased stress imposed upon them during fault conditions.

In the Benning generating station there were installed 64 General Electric type FH cell-mounted oil circuit breakers. While of ample interrupting capacity when originally installed, and notwithstanding that bus tie reactors were subsequently installed to limit the flow of fault current, nevertheless they were exposed to short-circuit currents in excess of their interrupting ratings.

To install non-oil blast breakers of similar type and with sufficient interrupting rating would have meant an increase of approximately 23 inches in the width of cell per breaker. This increase of width would have necessitated additional floor space of some 1,100 sq.ft. and would have required the razing and rebuilding of 258 vertical walls and barriers—about 180 tons of concrete; the replacement of 128 alberene stone slabs, 8x44x2 in., together with the necessary rearrangement of cable and instrument and control wiring; all at a time when the station must be continuously maintaining service.



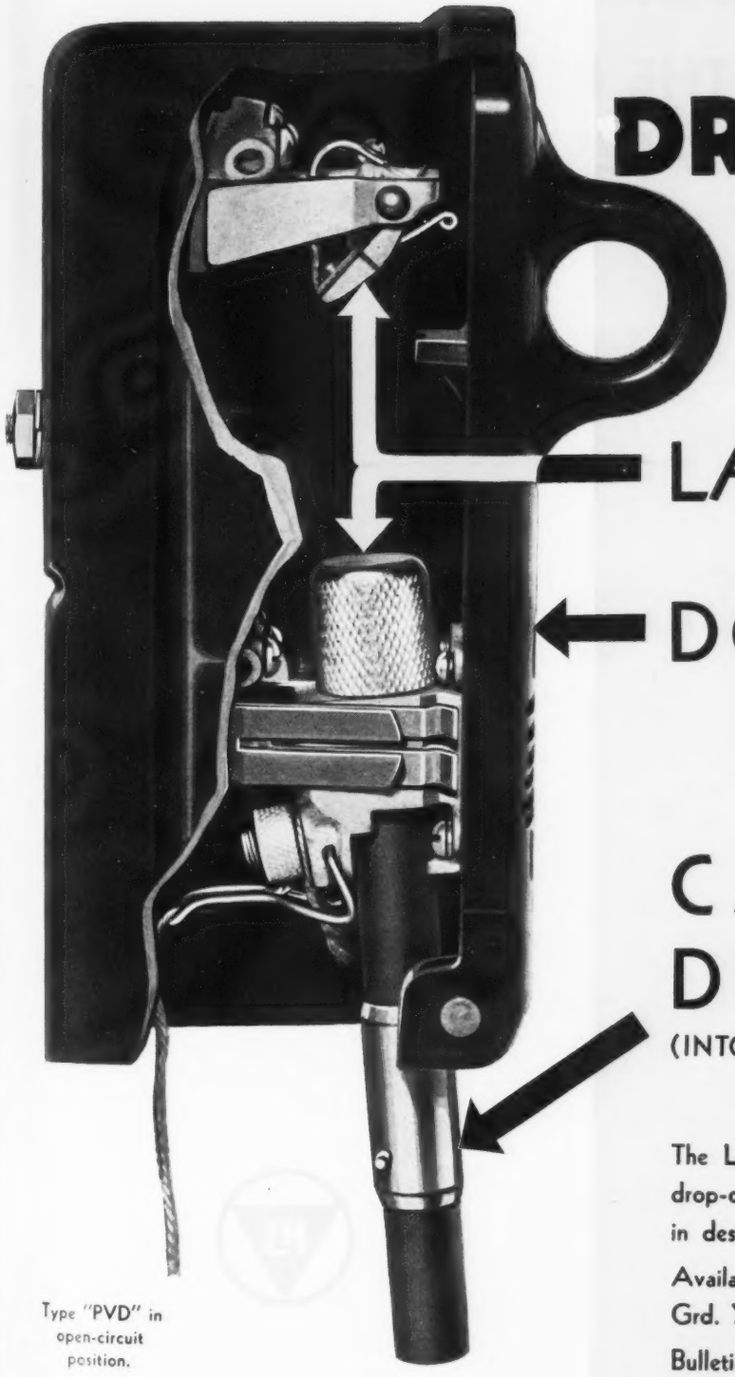
Benning station breakers modernized by addition of oil blast baffles

Interrupting rating doubled without change in cell structure or dimensions. The average time required for the installation by one man and helper was seven hours, only a little more labor than required for the periodic inspection.

Such a rebuilding project would not only have been very costly, but also would have been extremely difficult to accomplish. Fortunately, the manufacturer of these breakers was able to offer, at a nominal cost, modernization parts in the form of oil-blast baffles, gates, support rods and upper insulators. These parts were scheduled for installation during the annual breaker inspection period for the station. Without requiring any changes in the breaker mechanism or the cell structure, the installation of these parts increased the interrupting rating of the breaker from 500,000 kva. to 1,000,000 kva.

A number of the substation breakers have likewise been modernized by the installation of the oil blast baffles in those of General Electric make and Deïon grids in those of Westinghouse manufacture. All of these modernized breakers have been in operation more than a year. The condition of these breakers upon inspection after interrupting a number of fault currents has shown material improvement. These installations, good examples of the practicability and economy of oil circuit breaker modernization, result in a feeling of safety and security.

THE L-M "PVD" CUTOUT DISCONNECTS AND DROPS OUT



Type "PVD" in open-circuit position.

LARGE AIR GAP!

DOOR STAYS CLOSED!

CARTRIDGE DROPS OUT!

(INTO A TELL-TALE SIGNAL POSITION)

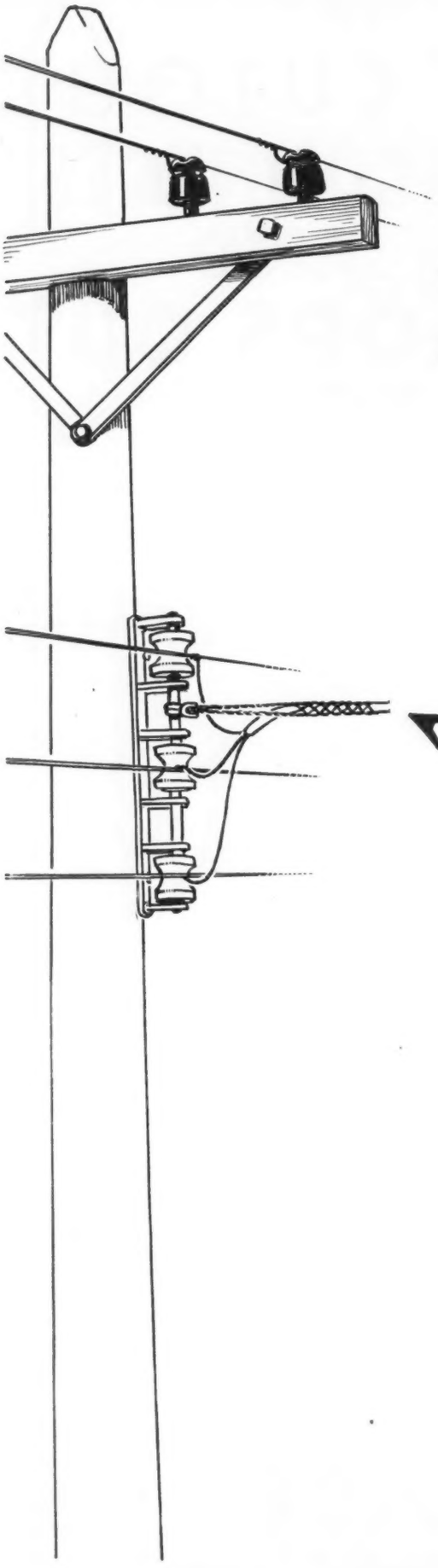
The L-M Type "PVD" is an entirely new idea in drop-out cutouts — original throughout. It is so simple in design, so unique in operation — you will like it.

Available for 5000 Volts and 7500/12500 Volts Grd. Y, 60 amperes.

Bulletin LMB-6353 gives full information. Ask for it!

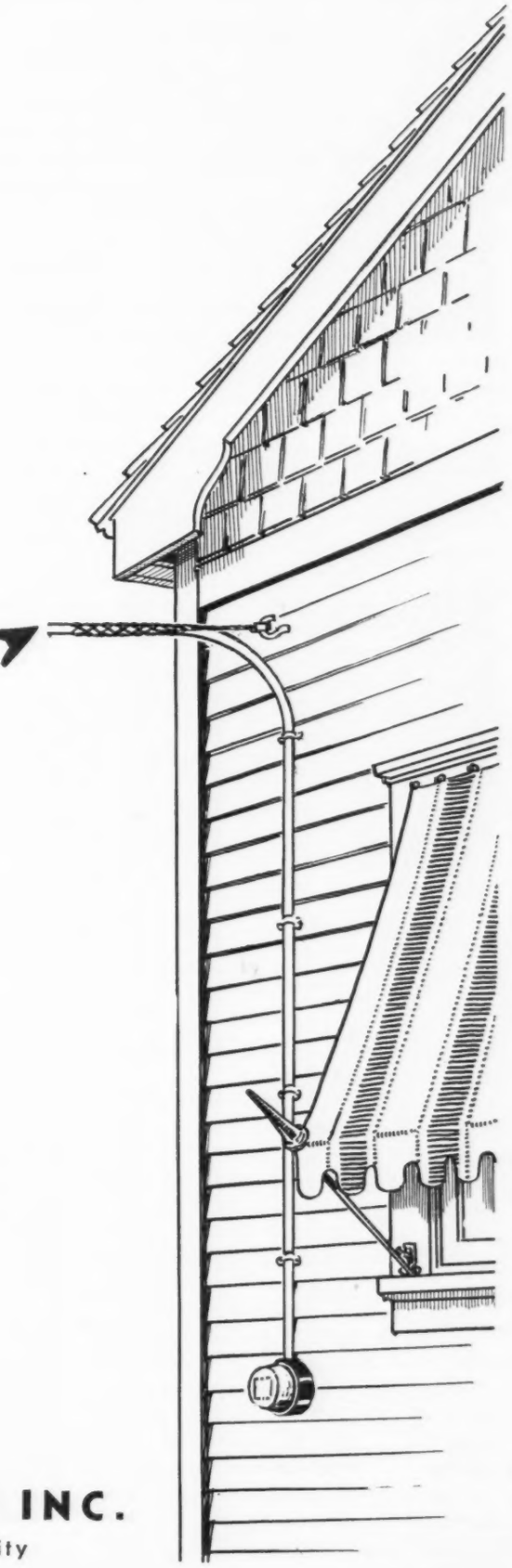
LINE MATERIAL CO

SOUTH MILWAUKEE, WISCONSIN, U. S. A.



THE PERFECT SUPPORT *for* SERVICE CABLE

THE ONLY CABLE SUPPORT WHICH CONFORMS PRE THE



THE SIZE, SHAPE AND ACTION OF THE CABLE.

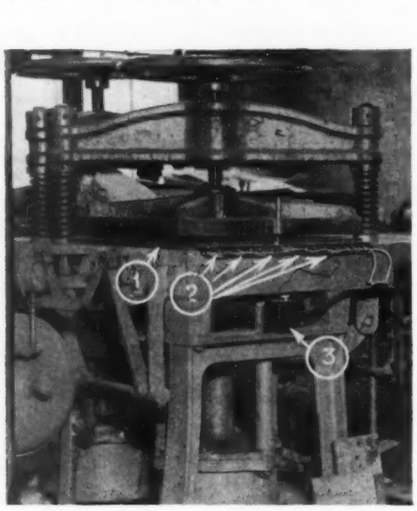
KELLEMS PRODUCTS INC.

100 Lafayette Street, New York City

Cuts Cost of Matrix Drying

By GLENN S. YOUNG
Power Sales Engineer
Kansas City Power & Light Co.,
Kansas City, Mo.

In modernizing a steam-heated matrix drying table in its stereotype foundry recently the Chase Bag Company, Kansas City, Mo., installed a number of strip heaters to replace steam.



Matrix drier converted to electric heat

A plate of steel (1) ⅛ in. thick was grooved to hold eight 750-watt strip heaters (2). Another groove was cut for the bulb of the thermostat (3). Except for these new parts the press remains as before.

Moist paper matrices from which printing press plates are made to reproduce the company name and insignia on their products were formerly dried by placing on this drying table, to which steam at 65 lb. pressure was applied. Electric heat, supplied by eight 750-watt strip heaters, with thermostatic control now automatically maintains the table at a constant temperature of 300 deg. F.

Savings made by shutting down the boiler plant during the summer have more than justified the expense of the installation. It is claimed that electric heat dries the matrix more quickly than steam, and operators report the results obtained are far superior. In fact, the operation has been found to be so satisfactory that the electrically heated equipment will be used the year around.

•

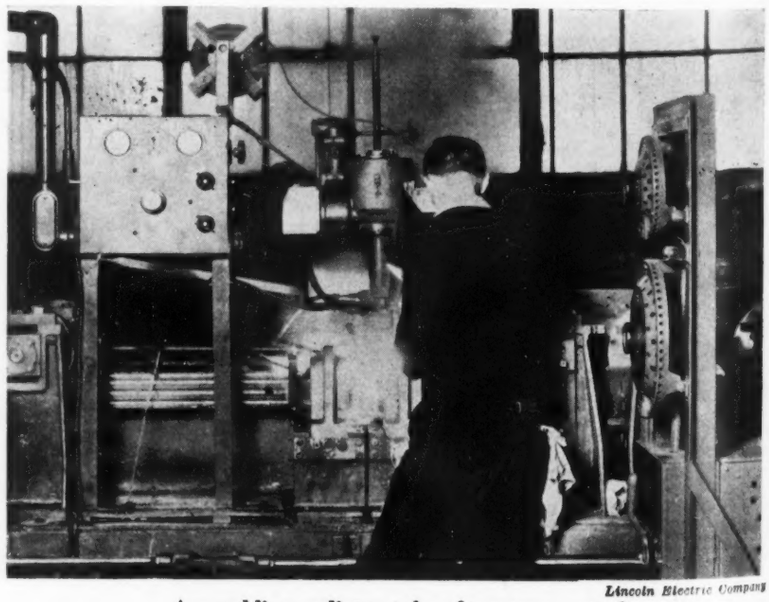
Transformer Tubes Continuous Welded

Strip steel is pressed with a series of grooves, folded over, crimped at the edges, arc welded with a continuous seam and cut off to proper length to make transformer radiator tubes by one production machine in the Pittsburgh plant of the Allis-Chalmers Manufacturing Company. The steel, 9⅝ in. wide, 16 gage, is drawn into the machine. The strip passes between rollers which press six grooves into it; the grooved strip is then folded over and the edges crimped; the formed tube then passes under the carbon arc, which welds the edges together. The welded tube emerges from the machine in a continuous piece. A saw, which travels in the same direction and at the same speed as the tube, cuts off the correct lengths, 5 to 10 ft. long, as required. The tubes are then manually welded into the familiar radiator assembly.

Motor Modernization Cuts Power Costs

A saving of $300 a month was effected by the Sperry Flour Mills, South Vallejo, Calif., by the conversion of two wound-rotor induction motors to synchronous motors. This saving represents a return of 33 per cent per year on the investment required. Modernization of existing equipment and the reduction of power bills, two factors in the operation of any system, require close and constant attention. Equipment that is allowed to remain in operation too long without alteration or modernization is apt to consume an excessively large amount of power when it is compared with similar equipment of more recent date.

The saving, in this case, effected by the conversion of the two fifteen-year-old, 400-hp. motors was due partly to power-factor correction, permitting operation at 0.8 power factor leading, and partly to increased efficiency. Power-factor improvement could have been obtained by the use of capacitors; however, modernization of the motors, giving increased life, proved more economical in this case, it was stated.



Lincoln Electric Company

Arc welding radiator tubes for power transformers

Graphic Solution of Motor Circuits

By J. H. F. WHITE
Engineering Department,
Westchester Lighting Company

Graphic methods afford a ready means of determining the predominant features of motor circuits. The accompanying curves will greatly facilitate cost estimates and should be useful in many ways for industrial engineers and electrical contractors. The graphs apply only to 220-volt, three-phase motors up to 100 hp., but may be extended by applying the requirements of the N.E. Code.

Feeder sizes and the ratings of feeder protective devices may be obtained from Fig. 1. Branch circuit sizes and ratings of their protective devices as well as the motor-running protection devices are given in Fig. 2.

In applying Fig. 1 the group horsepower should be used and increased by 25 per cent of the rating of the largest motor. The rating for the feeder protective devices can be increased over the value obtained if it does not exceed the collective rating of the branch circuit protective devices. However, the rating of feeder protection should coincide as nearly as possible with the capacity of the feeder.

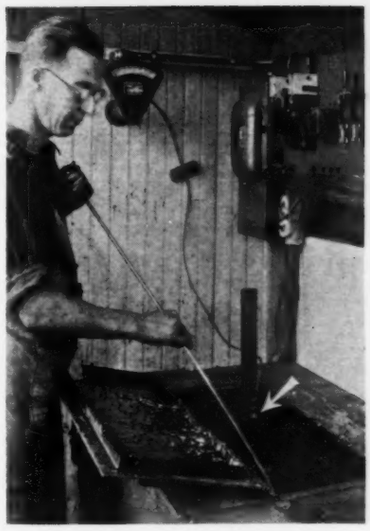
It should be remembered in applying Fig. 2 that there are different code requirements for the protection of different type motors. Consequently separate curves are given for three common types. If automatic circuit breakers are used on the branch circuits a special study should be made and their settings adjusted to conform to the local code requirements.

•

Strip-Unit Heat Oil-Drawing Furnace

Many varieties of metal stampings are turned out by the Master Products Company of Cleveland. In this work many dies of different sizes and other kinds of tools are used, all of which must have a hard outer surface over a tough interior grain structure. Such dies and tools are hardened in an electric furnace and are then drawn in a small oil-drawing furnace especially built for the purpose.

This furnace, in reality a pot of rectangular shape, is built up of an oil container placed between strip heaters, plus a 6-in. insulation and an outer metal shell. Four strip heaters are located on each side of the oil container and two underneath. Wiring is so arranged that all ten of the heaters or only half of them may be used at one time. The temperature of the oil is maintained automatically at any point between 500 and 700 deg. F. Oil capacity of the furnace is 8 gal. and the electrical capacity of the strip heaters is 1 kw.



One kilowatt heats 8-gal. oil-drawing bath

Fig. 1—Feeder sizes and rating of feeder protective devices for motor group

Increase group hp. by 25 per cent of rating of largest motor in applying chart. Based on average current per phase per hp. in each size range and on wire and fuse size for total current.

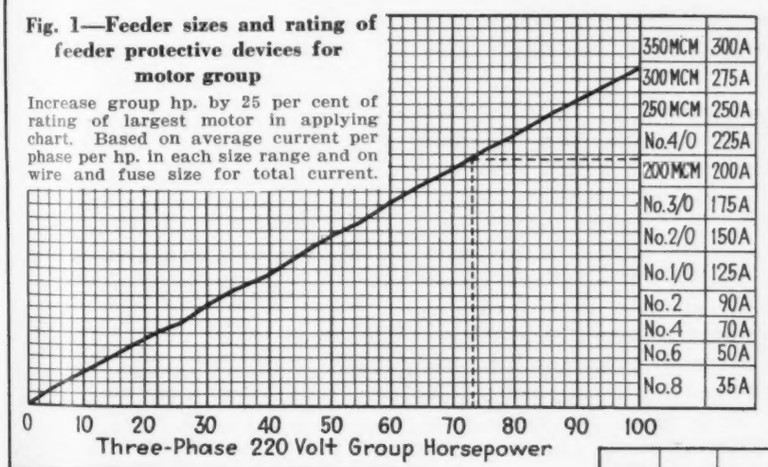
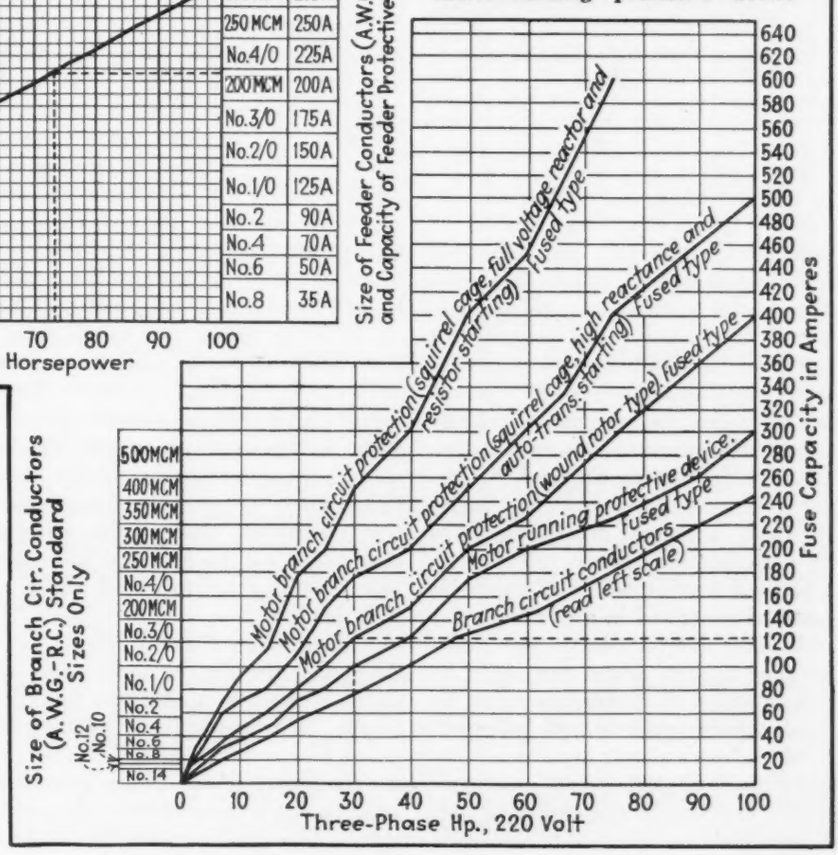
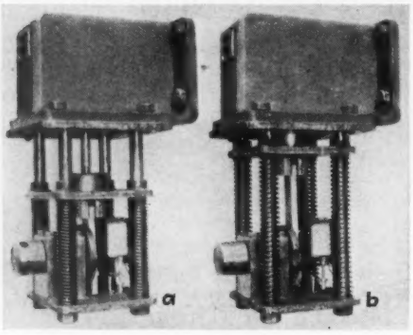


Fig. 2—Size of branch circuits and ratings of circuit protection and motor-running protective device


Motor branch circuit protection (squirrel cage, full voltage reactor and resistor starting) fused type
Motor branch circuit protection (squirrel cage, high reactance and auto-trans. starting) fused type
Motor branch circuit protection (wound rotor type) fused type
Motor running protective device. fused type
Branch circuit conductors (read left scale)
Size of Branch Cir. Conductors (A.W.G.-R.C.) Standard Sizes Only
500MCM
400MCM
350MCM
300MCM
250MCM
No.4/0
200MCM
No.3/0
No.2/0
No.1/0
No.2
No.4
No.6
No.8
No.10
No.12
No.14
0 10 20 30 40 50 60 70 80 90 100
Three-Phase Hp., 220 Volt
Fuse Capacity in Amperes
640 620 600 580 560 540 520 500 480 460 440 420 400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20

Springs Accelerate Breaker Closing

In order to justify the short-circuit rating of a breaker it is essential to establish its making capacity rating as well as its breaking capacity rating. The transitional stage from the least possible contact in the breaker to full contact should be made as short as possible and, to accomplish this, a circuit breaker should always be closed quickly and without hesitation in case a fault should exist on the circuit into which it is being switched.



Springs enhance "making" capacity of breakers

(a) Springs compressed ready for closing breaker; (b) springs released and breaker closed.

Electrical closing has generally been accepted as a satisfactory solution to the problem of closing high-power breakers, but the necessity for the provision and maintenance of auxiliary supplies has proved an obstacle to the universal use of electrically operated equipments. Ferguson, Pailin, Ltd., of Manchester, England, has developed an expansion-closing device in which the circuit breaker is closed by utilizing the energy released on igniting a small quantity of explosive material contained in a cartridge.

Another development is one incorporating springs which can easily be compressed with a slow movement by hand, the energy so stored being utilized to close a circuit breaker smartly and without hesitation.

The mechanism consists of a carriage which is actuated to compress the springs by means of a toggle link; the latter is operated by rotation of a shaft extending through the front of the mechanism cover by means of a suitable lever. The springs are compressed until the link is almost "on toggle," when a small roller latches the link in position. The operating lever is then removed, leaving the closing spring mechanism fully charged. By actuating a small lever the spring mechanism is released to close the switch; speed of closing is quite independent of the operator. Alternately, a small low-power release coil can be fitted if remote operation is desired.

•

Bucket Test Shows Least Pull-Up Torque

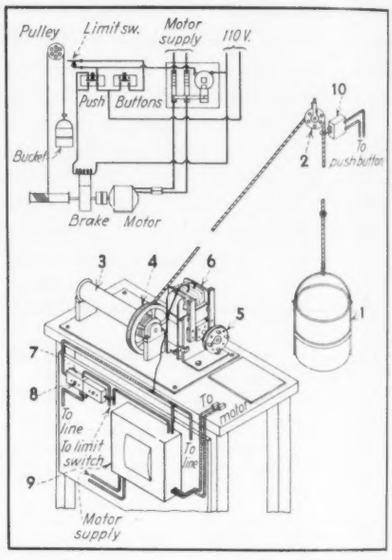
By H. B. DUFFUS
In charge of Small Motor Testing
Westinghouse Electric & Manufacturing Company, East Springfield, Mass.

The "bucket test," providing constant torque for accurately determining the minimum torque point of a small motor, can be done in a few minutes, yet simulates more closely than any other method of test the extreme condition a motor will operate under in service. Results compare closely and consistently with the minimum torque points as recorded on the speed torque curve of the motor. The minimum torque a motor will carry from standstill to the operating speed is termed "pull-up" torque. This torque can be effected considerably by such discrepancies as wrong switch speed, sluggish switch, poorly soldered rotor, wrong rotor skew, defective condenser, and similar defects that might not be apparent with the motor coming up to speed under a light load.

Although too time-taking for production purposes, the most accurate method of determining the pull-up torque of a motor is by plotting a speed torque curve using an electric dynamometer, which shows any harmonic cusps or any deviation from the standard curve characteristics of the motor. In line production the pull-up torque is often measured by a prony brake, giving only relative results and not as reliable as the bucket method. The bucket test method of measuring pull-up torque, while not fast enough to handle line production, adapts itself readily to the test of a group of motors that are under question.

When testing, it is essential that the ammeter be observed carefully to assure that the motor has cut over to the running connection before the bucket reaches the end of its travel. It is also necessary to limit the number of operations in finding the correct weight to a minimum, to prevent overheating the motor from too much running on the starting winding. If this occurs, the motor should be set to one side and rechecked later.

A curve is plotted to calibrate the

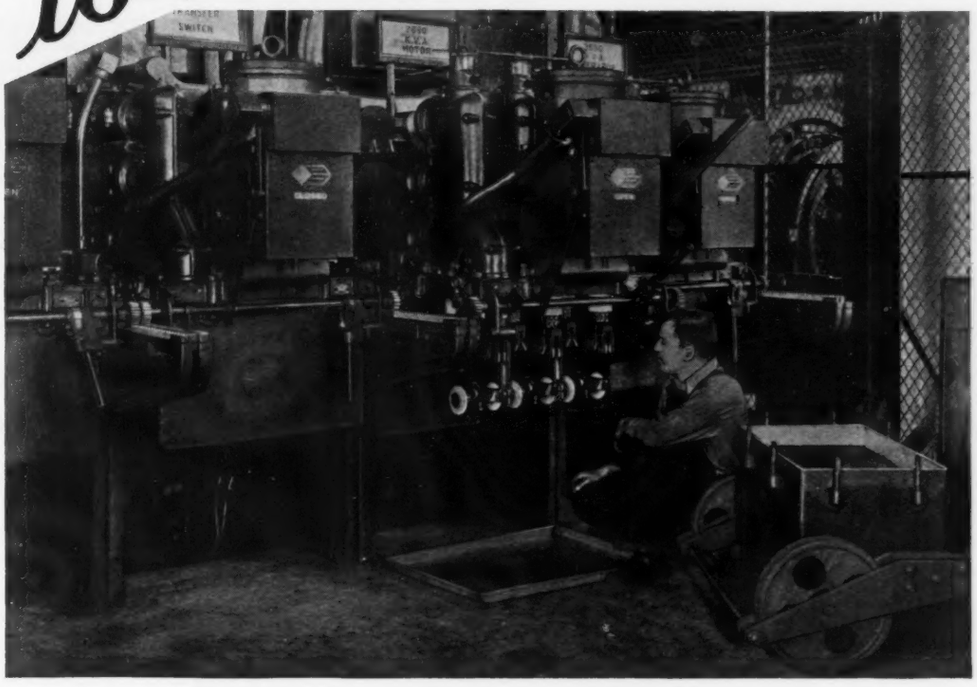


Weights decreased until small motor "pulls up"

With the empty bucket several inches off the floor, estimated weight corresponding anticipated pull-up torque is put in the bucket and the motor under test, driving coupling 5, starts under dead load, hoisting the weight. Process is repeated until weight has been added that is greater than the motor will pull up to operating speed. In this case the ammeter gives no indication of a transfer to the running winding, or the motor cycles between the running connection and the starting connections due to the overload. The last bucket weight that the motor successfully pulled up is recorded as the pull-up weight.

Easy to Check

Breaker inspection is simple with Allis-Chalmers Reyrolle Armorclad Horizontal Drawout Switchgear. View shows one breaker in disconnect position with tank removed for inspection of contacts.



Horizontal Drawout Armorclad Switchgear

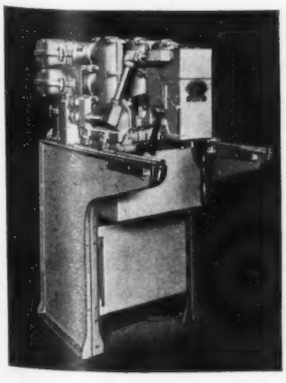
HORIZONTAL Drawout Armorclad Switchgear is designed to give maximum convenience and reliability in service, rather than for low manufacturing cost. It provides the following features not found in other types of metalclad switchgear.

1.—Breaker is made accessible for inspection by an easy horizontal movement, requiring little effort, and only a few minutes time.

2.—High tension buses and conductors are embedded in compound, permanently insuring insulation safety.

3.—Expulsion Port Breakers, which incorporate an arc extinguishing principle giving less arcing time, lower maintenance and wider application.

Write to Allis-Chalmers Mfg. Co., Milwaukee, Wis., for further information.



ALLIS-CHALMERS

REYROLLE SWITCHGEAR

bucket weight in terms of motor torque, by letting the bucket with various known weights drive a prony brake connected to coupling (No. 5 in sketch) and reading from scales the ounce feet equivalent to the bucket weight in pounds. Torque is plotted in ounce feet as ordinates, the bucket weight in pounds as abscissa.

•

Holds Meter Load Constant for Tests

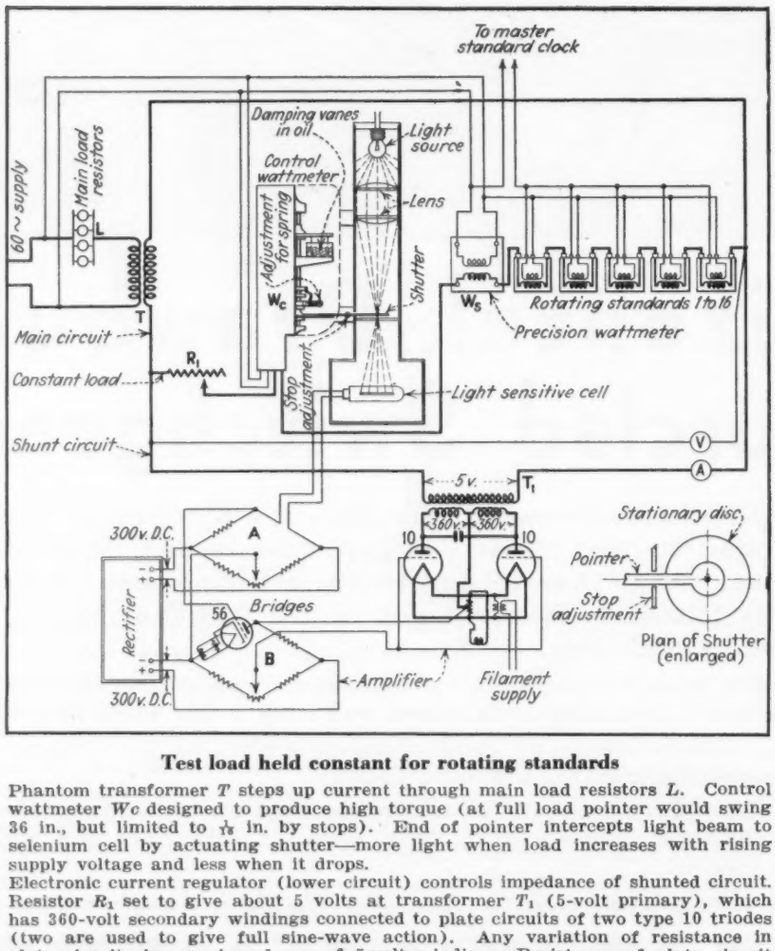
By W. C. WOODSON
Assistant Engineer Meter Bureau
New York Edison Company

Personal error in timing test runs of portable rotating standard watthour meters has been reduced to negligible value by automatic timing from a master clock. But with normal variation in supply voltage it remains difficult to hold the other factor—load, constant manually to within 0.2 or 0.3 per cent during test. To eliminate this possible error a circuit has been developed to maintain constant load by means of a control wattmeter and light-sensitive cell.

There is the usual resistor L (Fig. 1) for setting the approximate load and variable resistor R_1 for manual adjustments. Shunted around the circuit through the control wattmeter, precision wattmeter and the meters under test is an electronic-type current regulator which in effect is a variable impedance automatically adjusted in value by the light beam responsive to the control wattmeter.

The general plan is to set the main load L so as to pass through the main secondary circuit a current which will give a little more than the desired load on the rotating standards and automatically to shunt around the constant load circuit just enough to bring the load on the standards down to the exact desired load. This load is then automatically held constant by the electronic regulator. Whenever the load voltage starts to rise the pointer of the control wattmeter moves up and allows more light to fall on the cell. This lowers the impedance of the shunt circuit, diverting current away from the meter circuit and restoring it to the desired preset value. The range of motion of the pointer of the control wattmeter in action is about $\frac{1}{64}$ in. and this represents about 0.05 per cent change in load. The control wattmeter is a watt-hour meter converted to wattmeter by installing a spring on the disk shaft. It has a small temperature error, but there can be little change in temperature during the two-minute duration of tests on the standards.

Various loads are obtained by means of current transformer not shown. The rotating standards and precision wattmeter W_s are connected to the proper load by means of a selector switch which makes all necessary connections in a single operation.



Test load held constant for rotating standards

Phantom transformer T steps up current through main load resistors L. Control wattmeter Wc designed to produce high torque (at full load pointer would swing 36 in., but limited to $\frac{1}{8}$ in. by stops). End of pointer intercepts light beam to selenium cell by actuating shutter—more light when load increases with rising supply voltage and less when it drops.

Electronic current regulator (lower circuit) controls impedance of shunted circuit. Resistor R_1 set to give about 5 volts at transformer T_1 (5-volt primary), which has 360-volt secondary windings connected to plate circuits of two type 10 triodes (two are used to give full sine-wave action). Any variation of resistance in plate circuit changes impedance of 5-volt winding. Resistance of plate circuit affected by change in grid potential imposed through medium of bridge circuits A and B.

Type 56 tube in B used to amplify output of selenium cell and has grid circuit connected across center points of A. Proper negative bias obtained by adjusting potentiometer rheostat (arrow at A). Plate circuit of 56 constitutes one arm of B. Grid supply of tubes 10 connected across centerpoints of B.

Condenser across T_1 partly compensates for magnetizing current in 5-volt winding and brings power factor of shunt circuit near unity.

•

Automatic Control for Load Voltages

Alternating-current, load-voltage control is attained automatically in a device described recently by H. J. White and M. E. Gardner before the American Physical Society by regulating the impedance of a choke coil to which the line voltage is applied.

An iron core choke coil provided with an auxiliary winding for direct current can have its impedance changed by regulating the direct current in the auxiliary coil. Current passing through the d.c. coil magnetizes the iron core, making it less receptive to flux from the a.c. coil, hence the impedance is lowered. In this manner the potential drop across the choke coil can be controlled by varying the magnitude of the current in the auxiliary coil.

Regulation can be made automatic by applying the load potential to a rectifier and filter unit and balancing this against potential from a battery. The resulting potential differences are amplified and applied to the grid of a small power tube, the plate current of which controls the current in the d.c. winding of the choke coil. Any change in applied voltage will thus be almost completely absorbed in the choke coil. This device can be designed to care for fluctuations of considerable magnitude.

An experimental model of the stabilizer controlling 10 amp. at 100 volts maintained load voltage constant within 0.2 volt for a line-voltage change of 20 volts.

TIRES FOR THIS CAN'T BE EXPECTED TO "TAKE IT" ON A TRUCK LIKE THIS

So General gives utilities first and only REAL TRUCK TIRE in light delivery sizes. Ends use of PASSENGER CAR TIRES on light trucks.

• It goes without saying that utilities' light trucks punish tires a lot more than do average passenger cars.

But until now only *passenger car tires* have been available for these light trucks in city and suburban service. That's why so many companies have been troubled with beads pulling out—sidewalls breaking down—casings bruised and broken—poor mileage and short tire life.

The new General *"Special Commercial"* is the *only* tire of truck construction that is made to fit the rims on your light trucks—the *only* tire that will do a real *truck tire* job from a mileage standpoint. It has heavier beads, heavier fabric, more rubber between the plies and a much thicker tread.

Your General Tire dealer can show you in plain figures what the "Special Commercial" can save you on your light trucks. He is a practical truck tire man with wide experience and accurate knowledge in fitting the right type and size of tire to *all your trucks,* no matter what they do. He has the most complete, most highly specialized line of truck tires in the business. This combination is worth real money to you.

3 REASONS WHY GENERALS ARE MORE PROFITABLE TO YOU:

1. Generals are stronger tires—additional full-width plies of powerful cord are anchored bead to bead—with no "idle" plies—no floating breaker-strips.

★ ★ ★

2. Generals are cooler tires—they flex uniformly without that heat-producing "hinging action" of ordinary breaker-strip tires.

★ ★ ★

3. Generals have "compact rubber" treads—their construction keeps the tread rubber compact and compressed so that it wears slowly and gives more miles.

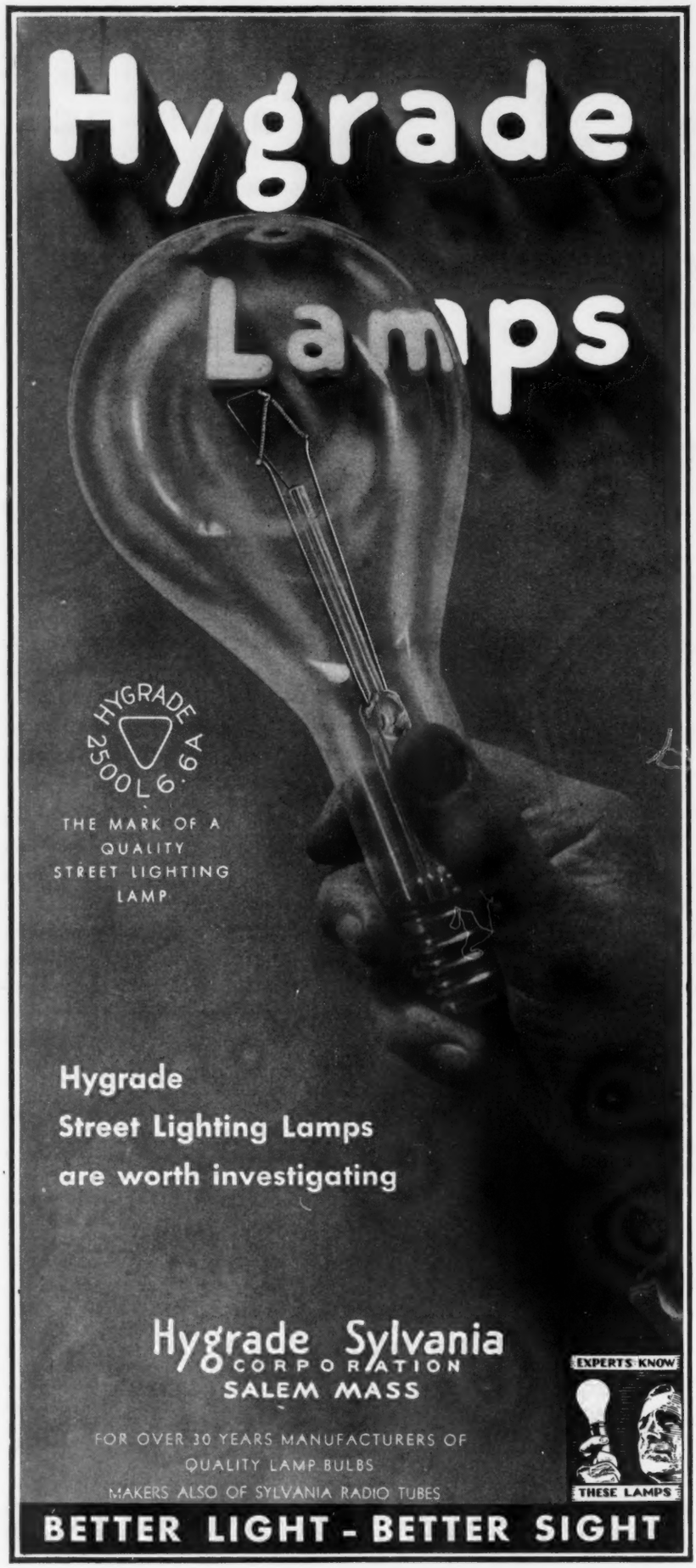
THE GENERAL SPECIAL COMMERCIAL

is used by many utilities on a majority of their trucks. This is only one of the complete line of Generals—each designed and built specifically to do a certain job better.

★

FREE this valuable booklet on how to get more service from your truck tires. Write The General Tire & Rubber Co., Akron, O.

GENERAL TRUCK TIRES



Secondary System Economy

[*Continued from page 23*]

tions, loads are never exactly uniformly distributed or of uniform size. A little larger wire than the one which is theoretically most economical may save a considerable amount of trouble and be well justified if no great increase in investment is involved. Consideration of all these factors has led to the selection of No. 2 as the standard size for the Detroit system.

Application to field conditions

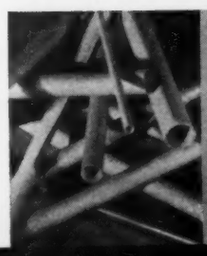
Up to this point the study has been on a rather ideal basis. The question may be raised as to the effect of field conditions, practical spacings, standard transformer sizes and increasing load. To answer this a study was made of the total accumulated annual charges over a period of twenty years using an increasing load and including cost of changing transformer sizes and spacings when necessary. A section of the work sheet curves is shown in Fig. 6, which give for No. 2 wire and various standard transformers the investment per 1,000 ft. at any load density. Limiting curves for 2½ per cent voltage drop, 2-4 volt flicker and 50 to 125 per cent transformer capacity are added to indicate the practical range in which any transformer may be used. It should be mentioned that the wire price used is relatively unimportant, a larger price merely raising all the curves. From these charts the curves of Figs. 7 and 8 were derived. A relatively slow growth of load is shown in Fig. 7 and Fig. 8 gives data for a fairly rapid growth. Curves for fixed spacings of 600, 700 and 800 ft. are shown up to load densities for which they are practicable. In the tabulation on Fig. 8 several methods of combining these spacings are compared, since for this rate of growth the larger spacings cannot be used throughout the assumed period of twenty years. The important evidence derived from this study is the comparatively small difference in the total for twenty years for any of the combinations used. That is to say, for practical use, if spacings between 600 and 800 ft. are laid out and transformers changed and moved as necessary to care for increasing load, an economical condition, quite close to the ideal, although naturally somewhat higher, results. Curves for No. 0 show similar results, but a higher total cost, as might be expected from Fig. 1.

CALLING ALL CARS . . .

Police radio, the longest arm of the law, swiftly dispatches our sentries of safety to the scene of peril. That such a little thing like radio insulation should fail in this emergency would be unthinkable. To the security of fellow men, SYNTHANE laminated bakelite adds a reliability for which no price is too great. Yet this same reliability — indispensable "in a pinch" — is yours at no premium in SYNTHANE.

SYNTHANE LAMINATED BAKELITE
SHEETS • RODS • TUBES
FABRICATED PARTS

Send for Sample Book



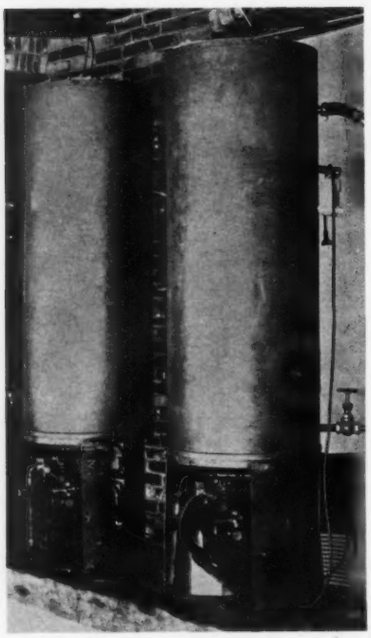
SYNTHANE
CORPORATION OAKS · PENNA

Hot Water From 4-6 Kw.-Hr. Daily

By GILBERT WILKES
Consulting Engineer, Reading, Pa.

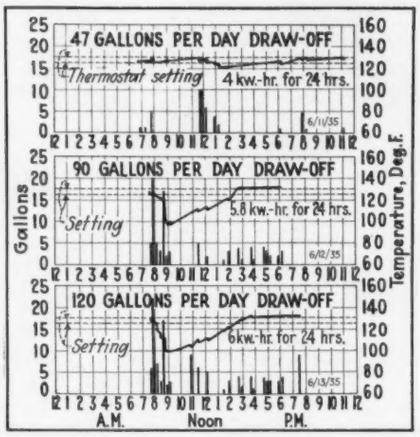
Results of tests on unit-type, reversed-refrigeration water heaters, based on three standard N.E.L.A. draw-off schedules, are shown in the accompanying graphs. Great improvements in efficiencies are shown over the performance of their predecessors. In each case a 50-gal. unit, equipped with a ⅓-hp. capacitor, motor-driven compressor, was used and the thermostat set for a 130-125-deg. range.

With the lowest draw-off (47 gal. per day) the temperature of the outcoming water remained fairly well within the established range, dropping below after the fifth consecutive demand, totaling about 32 gal. around noon. The energy consumption that day was 4 kw.-hr. for the entire 24 hours. Temperatures departed more with the 90- and 120-gal. draw-off schedules, dropping to a little less than 100 deg. after heavy withdrawals around 8-9 a.m. In both of these cases recovery of 130-deg. temperature was attained in about six hours with the intermediate withdrawals shown. On these schedules the energy consumption was 5.8 and 6 kw.-hr., respectively, per 24 hours. When standing by, the energy consumption was 1.1 kw.-hr. per 24 hours.



Self-contained reversed-refrigeration water heaters and equipment in base

The net heat extraction rate is 3,000 B.t.u.s per hour.



Performance of reversed-refrigeration heaters with three draw-off schedules

Applies to 50-gal. units with average water inlet temperature of 70 deg. F. Consumption without draw-off was 1.1 kw.-hr. per 24 hours.

Selling Refrigeration in Cold Country

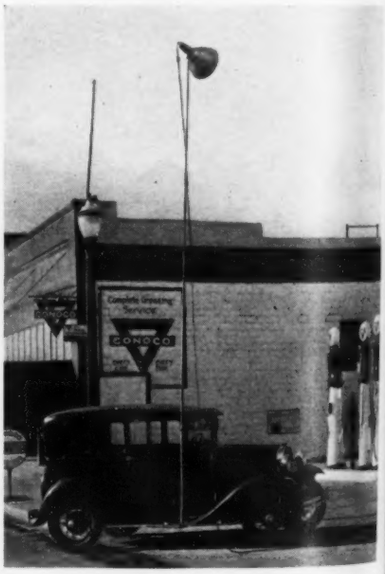
In Sheboygan, Wis., on July 1 there were only 216 electric refrigerators in use among its 10,700 electric consumers. The Wisconsin Power & Light Company organized an Electrical Refrigeration Bureau. A fund of $2,000 was set up, with nine manufacturers participating. A five weeks' campaign was put on and 251 more refrigerators were sold.

Sheboygan has cold winters and natural ice is easy to buy. But the campaign was built around health and savings. Merchandise credit certificates good for $10 on a chest top refrigerator were distributed by messengers to 3,000 minimum bill consumers, 36 months' time was offered and 100 refrigerators were sold the first week. Then came "cold cooking" schools. The newspaper advertising was supported by radio, direct mail and various displays.

Simple Demonstration Car Sells Lighting

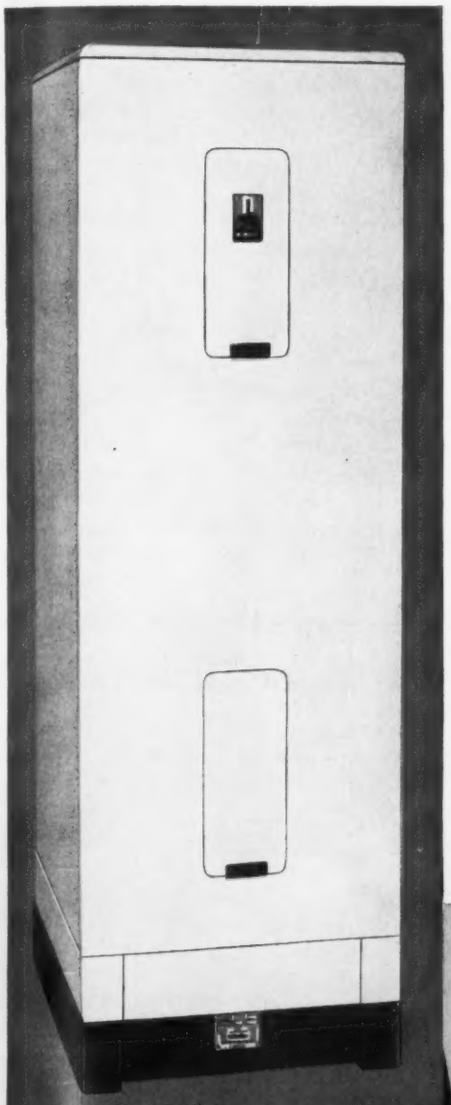
Floodlighting, as a means of building business for the small customer, is readily sold if a demonstration can be made. Pacific Power & Light Company uses an inexpensive kit which has sold approximately 750 watts of floodlighting for each demonstration.

It consists of telescoping steel tubes which act as the support for a floodlighting unit. The unit is mounted on the side of the salesman's car, as shown in the accompanying illustration. When a demonstration is made the unit is plugged into an outlet in the prospect's premises. Thus, by actual test, the improved appearance of the establishment is shown. The portable demonstration unit is inexpensive to install and can be readily set up to help the salesman build additional lighting load.



Salesman's car equipped with floodlighting demonstrator

new HOTPOINT ELECTRIC WATER HEATERS OPEN VAST LOAD BUILDING OPPORTUNITIES



The **VOGUE**—*Hotpoint's new, modern style square-type water heater gives hot water every hour of the day or night without one minute's attention from you.*

There is a growing demand for hot water supply among the homes of America. This demand opens a new opportunity for the sale of water heaters. Hotpoint answers the demand for a fully automatic water heater which can be left "on" when the family leaves home—without fear or worry.

● Hotpoint Water Heater's active appeal to the public is found in its cleanliness, safety and fully automatic operation. Utility customers, seeking for quick and continuous load-building appliances, have found a profitable answer in Hotpoint Electric Water Heaters.

Calrod, Hotpoint's sealed electric heating coil, delivers its heat directly to the water—no heat loss. Calrod, in its heating and cooling, expands and contracts, thereby eliminating lime deposit which interferes with efficiency and life of most other water heaters.

Hotpoint not only offers you a superior electric water heater, but furnishes full sales plans, sales promotion material and newspaper advertising service.

Write today for Hotpoint's Water Heater catalog and "Pure Velvet" Fall Sales Plan. Edison General Electric Appliance Co., Inc., 5618 West Taylor Street, Chicago, Ill.

Be sure to see "Old Faithful"—
the new Hotpoint Water Heater sound movie sales film

Look over Hotpoint's fall sales promotional material which emphasizes the fact that the furnace coil does not furnish "FREE" hot water. This is timely selling material for fall and winter.

AN ELECTRIC WATER HEATING PROGRAM
PURE VELVET
THE PARASITE...
Coal Pile
THE Furnace Coil is no bargain FOR WATER HEATING
HOT WATER IS SO NECESSARY for modern living
ELECTRICITY
Why pay double FOR HOT WATER?

ELECTRIC WATER **Hotpoint** HEATER

Building Water Heater Load

A Comparison of the Methods and Experience of 19 Power Companies That Stand at the Top in the Number They Sold Last Year—A Review of Local Conditions and the Results

WATER HEATER sales create domestic load in the biggest chunks offered by any household use of electric service. Each one is good for a consumption of 3,000 kw.-hr. a year, on a fair valuation. The appliance is worth its cost to the household if the rate is right. Why, then, are so few power companies selling them in a serious way?

The water heater follows the range in the normal development of home equipment. Because the range has come so slowly, water heating has also lagged. But electric cooking now has become the "white hope" of the power industry. More and more utilities are selling them and in greater number. In the first half of this year 100-odd power companies, serving more than 10,000,000 domestic consumers—more than half the country—sold 39,214 ranges, but only 16,395 water heaters. In the same period their dealers sold 14,494 ranges, but only 3,259 water heaters. Yet water heating builds domestic load twice as fast as cooking. So, since load is needed so urgently, we may look to see a rapid acceleration in water heater promotion and sales in the next few years. And it is worth while to study the methods of those companies that are already selling them successfully.

In the analysis of the merchandising activities of these 100 companies for the full year of 1934, published in ELECTRICAL WORLD on March 2, certain companies were outstanding in the number of water heaters they sold. The accompanying tables present a detailed comparison of nineteen of them. They vary in size from 547,986 domestic consumers to 16,362. They are scattered over the country. Six are in the far West, where electric cooking and water heating has been pushed harder and longer than in the rest of the country. Five of these companies are in the Southeast, where the pressure of T.V.A. has started intense load building. The two companies that put the largest number of water heaters on their lines in the last eighteen months, however, were located in the East.

How Nineteen Power Companies Sell Water Heaters

A close comparison of methods and results—Experience of a group of companies which have led in load building in the last eighteen months

TABLE I

Company	Total Domestic Consumers Dec. 31, 1934	Av. Total Dom. Consumption 1934	Av. Revenue from Dom. Consumers 1934	Av. Dom. Cost per Kw.-Hr. Cents 1934	Av. Sales Appl. per Consumer 1934	Present Sat. Elec. W. H. %	W. Htr. Saturation Emp. %	W. Heat. Rate Av. Cents	Total Water Heaters Sold by Company						Total Water Heaters Sold By Dealers—Est.			% Dealer Sales 18 mos.	Put Out On Rental		
									6 Mos. 1935	1934	1933	1932	1931	1930	6 Mos. 1935	1934	1933		6 Mos 1935	1934	1933
A	547,986	575	$32.58	5.66	$1.18	0.7	27	1.0	2,116	1,298	988	374	259	193	125	50	25	5	.....	.....	.....
B	533,123	675	34.30	5.08	3.75	0.5	3	1.0	198	878	95	361	187	92	50	114	79	13	1,304	1,149	.....
C	527,185	726	32.57	4.49	.....	3.6	.....	[A]1.5	872	2,354	1,457	1,739	1,871	2,388	214	476	664	17	.....	.....	.....
D	300,690	609	33.96	5.58	2.98	1.0	15	1.0	1,785	1,405	100	127	240	284	274	230	.....	14	.....	.....	.....
E	295,793	530	35.75	6.75	5.09	0.5	.....	1.5	361	407	490	472	69	97	47	33	70	9	.....	.....	.....
F	278,357	665	27.97	4.21	6.10	.....	.....	1.1	364	544	256	229	366	224	121	104	35	20	.....	.....	.....
G	155,781	664	31.21	4.70	8.00	0.5	.....	1.8	194	270	39	95	198	159	11	6	.....	4	.....	.....	.....
H	141,507	993	31.02	3.12	2.72	8.0	18	0.75	915	847	306	884	1,286	1,706	311	301	642	27	.....	.....	.....
I	126,665	687	40.95	5.96	7.65	0.9	.....	1.25	300	327	200	105	198	255	75	50	30	17	24	.....	.....
J	120,033	888	35.53	4.00	20.40	4.0	.....	0.8	1,041	1,896	117	139	841	487	90	4	2	3	13	11	11
K	94,271	774	31.96	4.13	19.35	3.7	.....	1.25	1,199	1,762	394	105	178	101	108	53	10	5	65	124	.....
L	92,787	1,015	30.95	3.04	4.05	4.6	15	[B] .8	419	708	241	.....	.....	.....	.....	15	25	.....	.....	.....	.....
M	75,416	871	33.44	3.84	15.20	4.7	.....	1.25	477	629	86	213	416	595	110	67	.....	14	—18	16	96
N	67,430	797	54.21	6.80	6.57	10.0	30	2.0	294	829	366	307	127	152	638	750	314	55	.....	.....	.....
O	52,715	680	40.00	5.88	15.75	3.5	.....	1.5	556	555	117	.....	.....	.....	8	20	5	3	.....	.....	.....
P	51,511	1,610	37.36	2.32	.....	21.0	.....	[C]0.8	565	787	131	218	722	1,097	49	52	66	7	.....	.....	.....
Q	43,482	1,236	37.00	2.99	8.08	12.0	.....	[D]0.8	528	376	147	325	707	998	117	144	94	22	.....	.....	.....
R	36,525	1,220	48.45	3.97	8.80	14.4	50	1.5	580	383	327	699	1,347	2,150	.....	.....	.....	.....	.....	.....	.....
S	16,362	710	34.15	4.80	9.20	7.8	17	1.0	73	475	299	.....	.....	.....	.....	3	9	.....	185	423	204
Total	3,557,619	[E] 838	[E]35.97	[F]4.29	[E]8.55	.....	.....	[E]1.19	12,837	16,730	6,156	6,392	9,012	10,978	2,348	2,472	2,070	.....	1,573	1,723	311

[A]Also 1 cent load limited. [B]Also flat rate, $5 per kilowatt per month continuous and $3.50 with limited load. [C]Off peak—also flat rate. [D]Off peak. Also flat rate controlled $3.50 per month. [E]Straight line average. [F]Weighted average.

TABLE II

Company	Type of Water Heaters Sold	No. W.H. Salesmen Average —1934	Consumers per Salesman 1934	Compensation Paid to Water Heater Salesmen	Does Co. Pay for Installation	Is Cost Added to Price	Does Co. Finance Time Sales	Maximum Time Given
A	Continuous, twin element, single meter	120	4,500	Salary $110 per month plus 15% net selling price. Yearly bonus	No	Yes	Yes	48 months
B	Off peak, 4 to 10:30 p.m. separate meter, local time switch	190	2,000	Salary $65, commissions 11% on sales plus variable load building bonus	Yes—Av. $33.44	No	Yes	36 months
C	Automatic, if possible with load limiting switch to range	44	12,000	Salary $80 to $100 per month plus $12 on water heating replacing competitive fuel or in new homes and $6 when replacing obsolete equipment or to apartment houses. $6 when sold through a dealer	Yes, up to $20 when sold with elec. range	$15 to $25 when range is in use	Yes	18 mos. to $156 24 mos. over $156
D	Off peak, 10 to 12 a.m., 4 to 7 p.m., separate meter, local time switch	75	City 20,000 Rural 2,000 to 3,000	Salary $50 per month min., 20% commission on monthly sales over $300	Yes—Av. $31.66	No	Yes	24 months
E	Off peak, 2 elements, one meter, local time switch	201	Rural 850 Urban 1800	Salary $55 per month plus $18 for 30-gal., $21.20 for 50-gal. and $26 for 80-gal. heaters	Yes, up to $15	No	Yes	24 months
F	Off peak, 6 to 12 a.m. 5 to 9 p.m., separate meter, local time switch. Will change to single meter with lower final step for water heating	125	No definite territory	Straight com. of 10% or salary of $55 per mo. plus 6% bonus over $1,200 sales per mo.	Yes—Av. $24	No	Yes	36 months
G	Off peak, 7 a.m. to 1 p.m., 4 to 10 p.m., separate meter, local time switch	11	No restricted territory	Salary $60—$25 car allowance—6% on net sales to $1,200, 10% over $1,200 plus bonus of $15 per water heater	Yes—Av. $33	No	Yes	36 months
H	Off peak, 3:30 to 7:30 p.m., twin unit, separate meter, local time switch	29	4,879	Straight salary—average $130 plus auto expense at 4½ cents per mile	No	Yes—Av. $16.50	Yes	24 months
I	Continuous automatic with split unit	58	1,500 to 2,500	*Territory Salesmen*—Sal. $60 per mo., 6% on sales up to $1,000 per mo. or 10% over $1,000. Load bldg. com. $10 per water heater. *Specialty salesmen*—$100-$125 per mo. Load bonus on all water heaters sold in his territory	Yes, up to $20—1935	1934—Yes	Yes	1934—24 mos. 1935—36 mos. or 48 mos. group purchase
J	Off peak, 7:30 a.m. to 1 p.m., 4:30 to 8 p.m., separate meter, local time switch	177	300 to 2,000	Salary $55 to $65 per mo. plus com. 6% on sales plus load bonus of $5 per heater	Yes to $45	No	Yes	36 mos. & 48 mos. when pur. in comb. with range and/or refrig.
K	Continuous automatic 30 gal. storage, 1,000 watt lower element, single meter. Rarely use upper element	47	1,520	Salary plus $50 per mo., 6% on net sales to $1,200 and 10% over $1,200, plus 2% on down payment bonus plus load bonus $8 per water heater	Yes to $45	No	Yes	36 mos. or 48 mos. group sales
L	Off peak, 4 to 8 p.m., twin unit storage, local time switch, separate meter	19	2,500	Base salary $50 plus graduated scale of load building bonuses and commissions	Yes—Av. $19	Yes	Yes	36 months
M	Continuous service automatic storage	29	1,200	Com. 5% on sales price plus $15 per water heater plus graduated volume bonus starting at $30 for $600 monthly sales plus small down payment com. Com. $5 on rentals	Yes—Av. $28	No	Yes	30 months
N	Continuous service, automatic storage, approx. 3 kw.	37	1,800	Straight salary from $125 to $175 per month plus campaign bonus, including sales secured through dealers.	Yes	Yes, $6 on 10 gal. $7 on 18 gal $8 on 3 gal. & over	Yes	18 mos. or 24 mos. during campaigns
O	Continuous service, automatic storage, one meter	30	1,700	Salary $45 per mo. plus $17.50 bonus on water heater sales excluding replacements	Yes	Yes—Av. $12	No	.....
P	Offer continuous flat rate, off-peak flat rate and off-peak metered service	23	2,477	Salary $125 per mo, plus load bonus—average income, $2,000 a year	Yes	No	Yes	24 months
Q	Off peak, 4 to 6 hours, separate meter on 8-mill rate. Also built-up job on single meter at flat rate	29	1,500	Average sal. of $125 per mo. plus com. $3.50 on 8-mill water heaters and $1.25 on flat rate heaters providing individual quota is reached	Yes—Av. $17.50	Yes	Yes	24 months
R	Twin unit storage one meter. Company has option to install time switch and for 6-hour off peak period	25	1,000	All salesmen paid sal. and com. About 80% sal. and 20% com. Com. is pooled in each operating div. and divided. No individual com.	No	Yes	Yes	24 to 36 months
S	Off peak, 4 hours, twin unit storage, local time switch	12	1,000	Salary $115 per mo. plus com. $9.45 per water heater on sales and $6.50 on rentals	Yes—Av. $32	No	Yes	24 months

The third in total output is on the Coast, the fourth in the Mississippi Valley and the fifth and sixth in the Southeast. The seventh and eighth are on the Coast. So it would seem that success in building water heater load does not depend upon location, high present saturation or years of promotion.

Local conditions affecting the domestic market for electricity are as varied among these companies as could be well imagined. The average total domestic consumption runs from highs of 1,610, 1,236 and 1,220 kw.-hr. in the far West to lows of 530 and 575 in the Northeast. Average revenue from domestic customers runs from highs of $54.21 and $40 in the Southeast, $48.45 in the Northwest and $40.95 in the Northeast, to lows of $27.97 and $31.21 in the Northeast and $30.95 and $31.02 in the Northwest. The average cost per kilowatt-hour to the home varies from highs of 6.75 and 5.96 cents in the Northeast and 6.80 and 5.88 cents in the Southeast to lows of 3.12, 3.04, 2.99 and 2.32 cents on the Coast. The average sales of appliances per consumer run from $20.40, $19.35, $15.75 and $15.20, all in the Southeast, to lows of $3.75, Northeast; $2.98, Central, and $2.72, Northwest. The present saturation of water heaters runs from highs of 21, 14.4 and 12 per cent in the far West and 10 in the Southeast to lows of 1 per cent in the Midwest and three 0.5's in the Northeast. So it is not the established local popularity of electric service that does it, either.

Rates, of course, have a lot to do with the ability of any utility to sell water heating in competition with gas, but among these companies rates have been put on a competitive basis or they wouldn't be in the top twenty. Ten of these companies provide no gas service themselves. Of the nine that do, four report the cost of both services about the same. With three companies electric water heating costs 1½ times the cost by gas. One of those most successful last year, located in the Southeast, has a 2-cent rate, which must make stiff selling. The next highest is 1.8 in the Northeast. Of the rest, four sell water heating at 1.5, three at 1.25, five at 1 cent, or 1.1, and four at 8 mills, or 7.5. Of these five, four are on the Coast and one is in the Southeast. But it isn't just the

rate that gets the business, within these limits. The company with the lowest rate stands No. 11 in number sold, the second best in rate stands No. 19, the third No. 14 and the fourth No. 11.

What's more, it is not the mere number of salesmen, though this is an indefinite measure because of the difference in practice. Some companies depend upon their regular domestic salesmen for water heaters, some use men who specialize on ranges and water heaters only. Some report part-time salesmen, and in this tabulation part-time salesmen are reckoned as ½ man. Territorial men who give full time and sell water heaters to the home along with the other appliances are rated as full men. But this Company E, with 201 salesmen, sold 768 water heaters in the eighteen months. Company B, with 190 salesmen, sold and rented 3,529; Company J, with 177 salesmen, sold and rented 2,961; Company F, with 125 salesmen, sold 908; Company A, with 120 salesmen, sold 3,414, and Company D, with 75 salesmen, sold 3,190, which doesn't make sense, but is accounted for by the amount of time that is devoted to the water heater by these men. Companies R, F and Q sold 963, 908 and 904, with 25, 125 and 29 salesmen, respectively. The only uniformity comes with Companies L, N and O, which sold about 1,100 and rented the same number with 19, 37, 30 and 29 salesmen, respectively.

These salesmen operate under practices that are widely different. On one system each salesman is supposed to cover 20,000 consumers in city territory, another 12,000, another 4,879, but with ten companies the assignment is between 1,000 and 2,500. Most companies pay the cost of installation—fifteen of them. One pays where the water heater is sold in combination with a range. Three don't pay. The cost of installations runs from $15 to $45. The average is around $28. Eight companies add the cost of installation to the price. Six companies are renting water heaters. On one system 1,573 were put out on rental in the first half of this year. All but one in this group finance equipment they sell, on easy payments. Nine stop at 24 months, six at 36. Five give free trial. Ten make trade-in allowances. Seven finance dealer sales, six pay the dealer a bonus, three pay a commission to their own salesmen on dealer sales to take them out of competition. Eleven companies offer off-peak and eight give continuous service. Of these eleven, eight use twin elements with a separate meter, two use one meter.

The total sales of water heaters reported by these companies showed a sharp gain in 1934 over 1933, except in two cases, and a large increase for the first half of the year in all except a few. In our recent study of 100 power companies, water heater sales

[*Continued on page 74*]

TABLE III

Company	Special Inducements Offered	Extent of Promotion Program	Dealer Co-operation Provided	Does Company Sell Gas
A	$15 trade-in allowance only	Newspaper, direct mail, billboard, demonstration, electric shows. Appropriation $20,000	Furnish newspaper adv., mail adv., display material. Sales training. Some trade-in allowance. Finance. Company salesmen paid com. on dealer sales	No
B	Rental activities during 1934 and 1935 at periodic intervals. No allowance for old equipment	Continuous promotion, periodic campaigns. Rental	Finance. Advertising support and sales training through electrical association. Bonus $5 for rental contracts, plus $5 when converted to sale	[G]Yes
C	None	Extensive continuous sales, with campaigns. Sales are handled by combination men	Advertising support, demonstrations and sales training through co-operative association. Com. $10 on each water heater sold by dealer	[H]Yes
D	Allowance of $10 for old equipment, including furnace coils, also free wiring	On 4/1/34 a five-year co-operative program started with quota of 3,000 storage heaters and 6,000 cheap installations. In 15 months 3,628 heaters have been sold	Finance, advertising support, free wiring, trade-in, home service, sales training and bonus of one water heater free for each 5 sold	[I]Yes
E	Free trial period	Continuous promotion, campaigns, newspaper adv., mail adv. with wiring allowance as feature	Feature dealers in advertising. Help with sales training. Pay wiring cost up $15	[G]Yes
F	Special cases free trial of 60 days. Allowances for old equipment	Two 6-week campaigns each year with low price leader	Economy purchase plan, advertising support to general market. Cost data. Regular salesman's com. for sales made on company floor, plus bonus	[I]Yes
G	Limited home demonstration where wiring is installed. Trade-in $2.50 for old furnace coil and/or $5 for old water heater (or tank)	Aggressive promotion full 12 months	Advertising, sends prospects to dealers, sales training and help, regular contact. Bonus $15 per water heater	No
H	None	80% merchandise appropriation applied to off-peak electric water heater development. Educational advertising, demonstrations and direct sales activity—also employee training.	Feature dealer in adv., sales training. Surveys, engineering and cost data and inspection service	[G]Yes
I	1934—$10 trade-in. No trial or rental; 1935—provides rental offer, free wiring but no trade-in	Active promotion with free wiring and longer terms, expect 70 to 100% increase over 1934.	Finance beginning 1935. Mail and newspaper adv. features dealers. Sales training and assistance	[I]Yes
J	Rental plan. Trade-in allowance $15 during campaign periods	Three yearly campaigns by all salesmen. Employees paid $1 for prospects sold. General appropriation 3½% of net sales applied to refrig., range and water heaters	Finance if desired. Advertising support. Free wiring. Service during guarantee for small charge	Yes
K	Rents 30 gal. continuous service heaters. No free trials. Trade-in max. $25 on larger heaters only	Use newspapers, direct mail, billboards and radio. 1935 advertising expenditures are 6% of sales.	Co-op. adv. and contact men. Sales training. Bonus same as Co. salesmen. Bonus to Co. salesmen on dealer sales. Service on dealer sales if desired	No
L	None	Continuous with 2 special campaigns, combined with range promotion. Will expend (1935) about $6,000 in newspaper and direct mail adv. for water heating	Dealers not selling water heaters	No
M	Rental plan available. No trial or allowance	Part of general program. Newspaper, bill stuffers and window display adv.; public demonstrations; electric shows; employee training schools; employee sales meetings; campaign contests	Water heater specialists assist with merch. adv. display and selling. Sales training. Bonus on sales	No
N	No rentals. Free trial of 60 days used as last resort. Small trade-in sometimes made during campaign	Extensive advertising. Three intensive 8-week campaigns per year	Finance, co-op. newspaper and outdoor adv. with dealer names. Four contact men. Sales training and assistance. Home service	[G]Yes
O	None	Periodic campaigns	Adv. features dealers. Sales help and training through co-ordinators. Pay Co. salesmen com. on dealer sales	No
P	30-day free trial	Consistent advertising; periodic campaigns	Dealers inactive but receive adv. support and sales help and training by specialists	No
Q	60-day trial. Estimated resale value allowed on old heaters	Continuous program with 4 campaign periods. Also included in the other major appliance campaigns. Adv. appropriation 3% of estimated dollar volume.	Advertising features dealers. Sales training, prospects, display material and service on water heaters sold	No
R	Small allowance on old heaters sold by company	Continuous advertising and sales program. Periodic campaigns with dollar down on special heater, 36 months and allowance on old heater, thermostat or cover. All-employee participation.	Dealers not selling water heaters	No
S	First 3 months rental allowed for old equipment. Rental plan	Extensive promotion for past 4 months. Large advertising schedule. Intensive efforts on water heaters during this period	No dealers handling water heaters, except on basis of company salesmen, with full support and compensation	No

[G]Costs same as gas. [H]Gas cheaper [I]Electric costs 1½ times gas

Plenty of *Rust-Free* Hot Water

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Purchasers of automatic water heaters want rust-free hot water, and plenty of it . . . not for just a few years, but indefinitely. And only a tank that *cannot* rust will satisfy this requirement.

Everdur . . . the ideal metal for tanks . . . is nearly all copper, made as strong and tough as steel by a special alloying process. Yet it is immune to rust. Since it welds as readily as steel, Everdur makes possible the *economical* production of non-rust tanks by welding—the sturdiest type of construction employed by tank makers. In addition to its great strength and corrosion resistance, Everdur is highly ductile—a combination of properties which enables Everdur tanks to undergo successfully the most drastic tests.

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EVERDUR METAL *for* TANKS

RUSTLESS AS COPPER . . . STRONG AS STEEL

for the first half of 1934 were 16,395, against 9,003 for the same period of 1933. Dealer sales jumped from 1,599 to 3,259. And this relationship between power company and dealer sales is interesting when we study the figures on these nineteen companies.

Company A put out 3,414 in the last eighteen months, while their dealers sold 175. Company C put out 3,226, while the dealers sold 690. Company D put out 3,190, while the dealers sold 504. Company J put out 2,937, while the dealers sold 94. Company K put out 2,961, while the dealers sold 161. The dealer percentages run from highs of 55 in the Southeast and 27 and 22 on the Coast to lows of 3 per cent with two Southeastern companies and 4 in the Northeast, while two far Western companies and one Southwestern utility report that their dealers sell no water heaters at all.

The dealer has been left out of the picture in some cases because the power company has been selling a local assembly, but after all it is a matter of merchandising a better hot water service to homes. And if the dealers of Company N sold 1,388 water heaters in the last year and a half and the dealers of Company C sold 690 and the H dealers sold 612 and the D dealers sold 504, those utilities where the dealers sell a negligible percentage or none at all are overlooking something important.

If these figures mean anything at all, it gets down to the matter of marketing. The companies that stand 1, 2, 3, 4 in size in this tabulation also stand 2, 1, 3, 4 in total water heaters put on the line in this period of eighteen months. But below that no relation between size, saturation, rate, average consumption or average appliance sales is apparent.

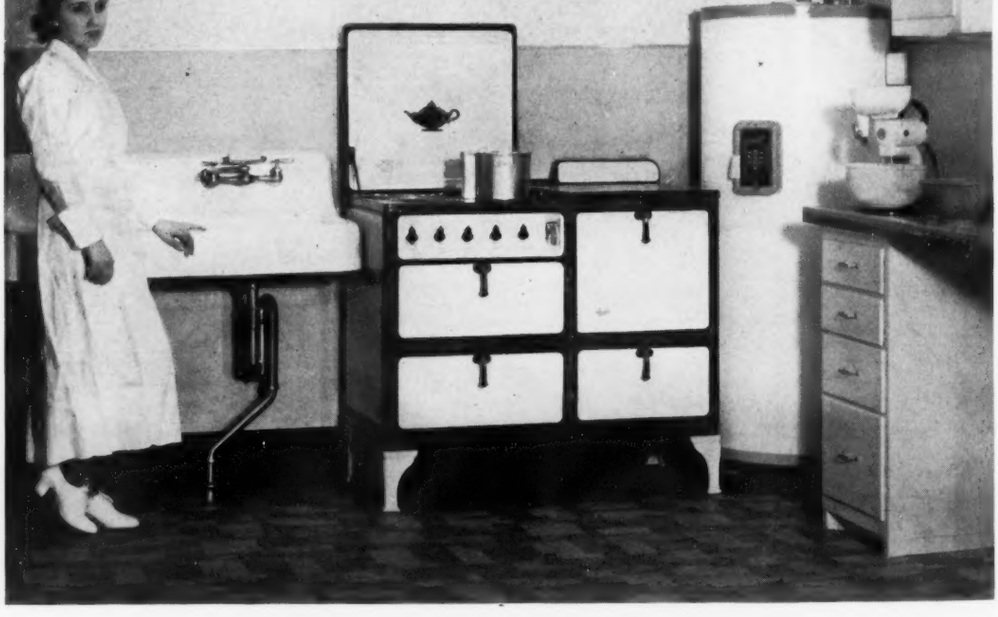
To get the load

All these companies advertise and send out salesmen to talk water heating. They pay the men commissions and bonuses to give them zeal. Most of them co-operate with the local dealers. Some give them generous support. Most of them have periodic campaigns in which the value of water heating is given wide publicity. But the figures show that the mere doing of these things, the mere providing of a rate and the usual inducements to buy do not insure success. Real progress depends upon the skillful organizing of all these influences and the intensity of the pressure of selling that is put behind them.

People in this country like hot water—they like it hot and plenty. And electric hot water heaters are salable or there wouldn't be some 201,000 of them now in use. Around 34,000 were sold in 1933 and 1934. This shows that it can be done. The building of this load waits only for two things: (1) a merchandising program that will organize every possible persuasion, influence and inducement—including rental—to make people want electric water heaters and (2) enough man-power to put them over. It calls for appropriations and operations on a large scale, to build this load up now and not by driblets year by year. Such a program will sell the employees of the power company first—immediately—and all the dealers—so that these electrical men will believe in what they sell. Then it will enlist every plumber and electrical dealer and contractor in the selling staff by making it profitable business for them.

The power companies in this group that rolled up the large totals performed no miracles. They used no conjure. They sold them—and so can every other utility—save only those which face gas competition, priced so low that it cannot be met—and even here there are many homes that can be sold, with a good rate, for the safety and superiority that can be offered. And that bars out a relatively small number of cities.

It all gets down to the simple question of how much this load is wanted and how soon? For experience has demonstrated that electric water heaters can be loaded on the line in direct proportion to the intensity of selling that is put behind them.



MEN OF THE INDUSTRY

E. N. Peak New President of Contractors Association

Earl N. Peak, president and general manager of the Marshall Electric Company, Marshalltown, Iowa, was elected president of the National Electrical Contractors Association at the recent convention in Chicago. A native of Wilsey, Kan., Mr. Peak entered the telephone industry in the service of the Farmers' Mutual Telephone Company at Jesup,

E. N. Peak

Iowa. Three years later he joined the Central Union Telephone Company of Moline, Ill., and after serving in various capacities he entered the employ of the Marshall Telephone Company at Marshalltown, remaining there for three years.

He spent the following three years as manager of a general construction and contracting company and after twelve years of such general experience Mr. Peak organized the Marshall Electric Company. For many years he has been active in association work, having been one of the organizers of the Iowa Association of Electragists. He has served as vice-president of the National Electrical Contractors Association for several years.

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▶ FRANK WEBSTER, for several years representative of the Link Belt Company with headquarters at Philadelphia, Pa., has been appointed New England sales manager, with offices in Boston, Mass.

▶ RALPH G. MACY of South Norwalk, Conn., special adviser to the federal government on utility matters, has been appointed chief engineer of the New Jersey Public Utility Commission, effective October 15. He succeeds Col. Philander Betts of Belmar.

▶ E. E. ACKLAND, illumination engineer with the Canadian General Electric Company at Vancouver for the past five years, has been appointed honorary trade commissioner and general representative of the New Zealand government at Vancouver, B. C.

▶ J. B. WILKINSON, chief engineer of the Fire Insurance Rating Bureau, Milwaukee, Wis., has been appointed a member of the Electrical Council of Underwriters' Laboratories. Mr. Wilkinson will fill the vacancy caused by the death last February of Frank R. Daniel.

▶ J. B. MCCABE, who is connected with Montreal Light, Heat & Power Consolidated, has been appointed treasurer of the Canadian Electrical Association, to succeed C. W. Hemming, resigned. Mr. Hemming had been treasurer for the past seven years.

▶ A. W. ROBERTSON, chairman of the board of the Westinghouse Electric & Manufacturing Company, was elected president of the Electrical Manufacturers Club at the closing session of its thirtieth annual conference. Others elected were Robert Edwards, New York, vice-president; Charles L. Peirce, Jr., Pittsburgh, secretary, and W. L. Hinds, Syracuse, treasurer.

▶ VAN S. PICKEL has been transferred as superintendent of the Ocoee No. 1 plants of the Tennessee Electric Power Company to the company's Nashville steam plant, where he will fill the vacancy caused by the death of Superintendent W. E. Campbell last June. THOMAS B. HARDIN, assistant to the superintendent of the Tennessee company's Hales Bar plants, succeeds Mr. Pickel at the Ocoee No. 1 stations. Both Mr. Pickel and Mr. Hardin have been with the Tennessee Electric Power Company since 1919.

▶ HARRIS E. DEXTER, general commercial manager of the Central Hudson Gas & Electric Corporation, has been elected to the board of directors of that company, succeeding George H. Howard of New York, resigned. Mr. Dexter, who joined the Central Hudson organization in 1927, has been responsible for the administration of the outstandingly progressive commercial and sales policies of that company. Beginning in 1928, the Central Hudson company began the development of its plan of sales co-operation with appliance dealers and was one of the first companies in the industry to recognize the possibilities of co-operative merchandising. From this early beginning co-operative merchandising as a policy has been advanced by a process of gradual evolution, under Mr. Dexter's direction, to its present status of co-operative action.

M. D. Engle Assumes New Engineering Duties

Melvin D. Engle has been appointed superintendent of the station engineering department of the Edison Electric Illuminating Company of Boston, following the retirement of George E. Seabury. A native of Maryland, Mr. Engle was graduated from the University of Michigan in 1918. He was formerly assistant to the electrical engineer of the

M. D. Engle

Consolidated Gas, Electric Light & Power Company, Baltimore, and subsequently assistant to the chief mechanical engineer with McClellan & Junkersfeld, consulting engineers, New York. He joined the Boston company in 1925 as assistant to the head of the department which he now has in charge.

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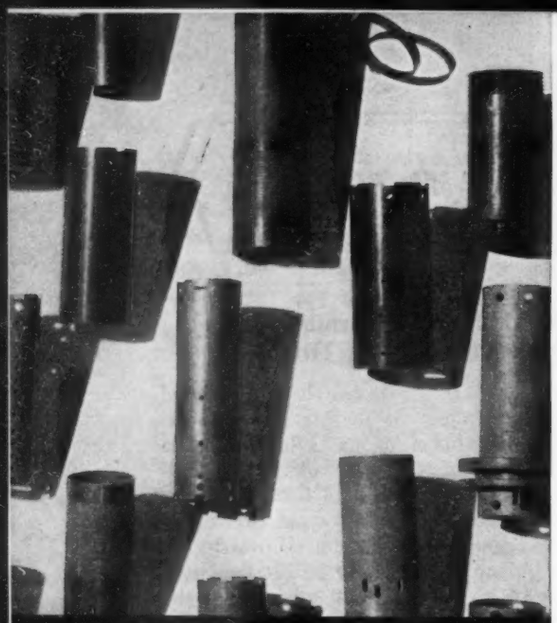
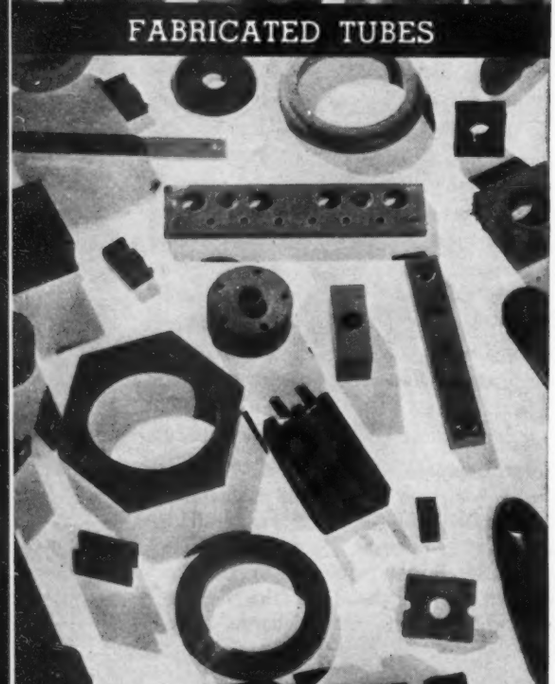
▶ GODFREY STRELINGER, who has been associated with Kelvinator Corporation in various capacities, has been appointed general assistant to the vice-president in charge of sales. He goes to his new position from the sales managership of Leonard Refrigerator Company. Mr. Strelinger joined the Leonard organization in 1933 after spending a year and a half as Kelvinator manager in Detroit.

▶ E. A. KEFGEN, manager of the range division of the Minnesota Power & Light Company since 1923 and from 1916 to that time in charge of the operations of one of its predecessor companies, has succeeded Howard J. Underhill as division manager of the company at Duluth and has been transferred to that city from Eveleth.

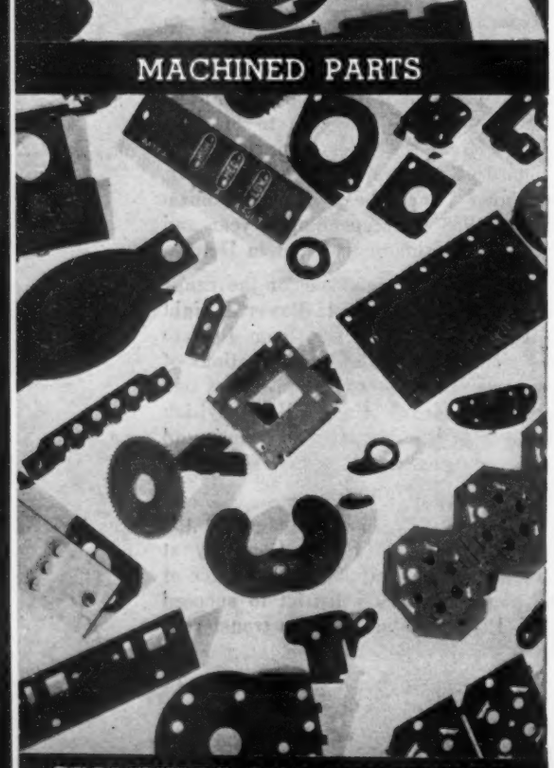
▶ D. R. BONNER, local manager of the Tennessee Electric Power Company at Clinton, has been appointed manager of the north Tennessee district to succeed C. E. Perkins, who has been transferred



FABRICATED TUBES



MACHINED PARTS



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to the middle Tennessee district. Mr. Bonner has been in the employ of the power company for the past nine years. W. L. ANDERSON, formerly local manager at Carthage, and more recently in charge of commercial merchandise sales for the north Tennessee district, was named local manager at Clinton.

▶ T. J. NEWCOMB, formerly Eastern manager of refrigeration sales of the Westinghouse Electric & Manufacturing Company, has been promoted to the position of manager of commercial refrigeration sales, with headquarters at Mansfield, Ohio.

▶ RALPH A. JOHNSON, power sales engineer for the utilities operated by the New England Power Association in the northeastern district, has been transferred to the Boston headquarters power sales staff of the New England Power Engineering & Service Corporation.

▶ C. E. PERKINS, manager of the Tennessee Electric Power Company for north Tennessee, has been appointed to the middle Tennessee position to succeed Clarence Watson, who has been assigned to the Cumberland district. Mr. Perkins has been associated with Tennessee Electric Power in various operating capacities for the past nine years.

▶ L. E. MORIER has been appointed vice-president and sales manager of the Brown Wood Preserving Company, Louisville, Ky. Mr. Morier's entire business career has been spent in the pole industry. For seventeen years he was connected with the Naugle Pole & Tie Company of Chicago in various capacities, principally in sales work. For the next nine years he was associated with the Page & Hill Company of Minneapolis and was district sales manager at Dayton, Ohio. In 1932 he joined the staff of the MacGillis & Gibbs Company of Milwaukee, Wis., in a similar capacity, still being located at Dayton. His present association with the Brown Wood Preserving Company was made on September 1.

▶ JOHN T. MOUNTAIN, for 36 years active in affairs of the Commonwealth Edison Company, recently retired. Mr. Mountain entered the employ of the old Chicago Edison Company in the statistical department, but soon took up operating work. As one of the earliest substation operators of the company, he was promoted to the newly organized load dispatcher's office, became chief load dispatcher, and later assistant to the chief operating engineer. In addition to his general interest in operating affairs he concerned himself especially with lamp matters and policies, as a member of the important lamp committee of the Association of Edison Illuminating Companies. During the last two years Mr. Mountain served as assistant service manager.

OBITUARY

J. Allen Johnson

Joseph Allen Johnson, chief engineer of the Buffalo, Niagara & Eastern Power Corporation and president of the American Institute of Electrical Engineers 1934-35, died October 4 at his home in Niagara Falls, N. Y., in his fifty-fourth year. Mr. Johnson had been associated with the power industry of the Niagara frontier since 1905, when he entered the employ of the Ontario Power Company, Niagara Falls, Ont., following graduation from the Worcester Polytechnic Institute.

In 1912 he was made electrical engineer of the Ontario Power Company and when that utility was purchased by the Hydro-Electric Power Commission of Ontario, five years later, he became assistant engineer for the commission, at the same time retaining his association with the utility. In 1918 he was appointed electrical engineer of the Cliff Electrical Distributing Company and Hydraulic Power Company of Niagara Falls, N. Y., and with the consolidation of these companies and the old Niagara Falls Power Company to form the Niagara Falls Power Company in 1918 he became electrical engineer of the enlarged company. In this capacity he was responsible for many important features of the electrical design of the Niagara developments during the period of their rapid growth from 1918 to 1924. In 1929 he was appointed chief electrical engineer of the Buffalo, Niagara & Eastern Power Corporation, the position he held at the time of his death.

J. A. Johnson

Mr. Johnson had been active in the American Institute of Electrical Engineers for a number of years and also in committee work for the Edison Electric Institute. Last June he was made the recipient of the honorary degree of doctor of engineering by the Worcester Polytechnic Institute with a citation that stated that Dr. Johnson had risen from a humble private in the army of electrical engineers who have labored and produced at Niagara Falls to high command, to be an authority in his chosen field and a consultant of repute and that "great honors have been his where there was much honor."

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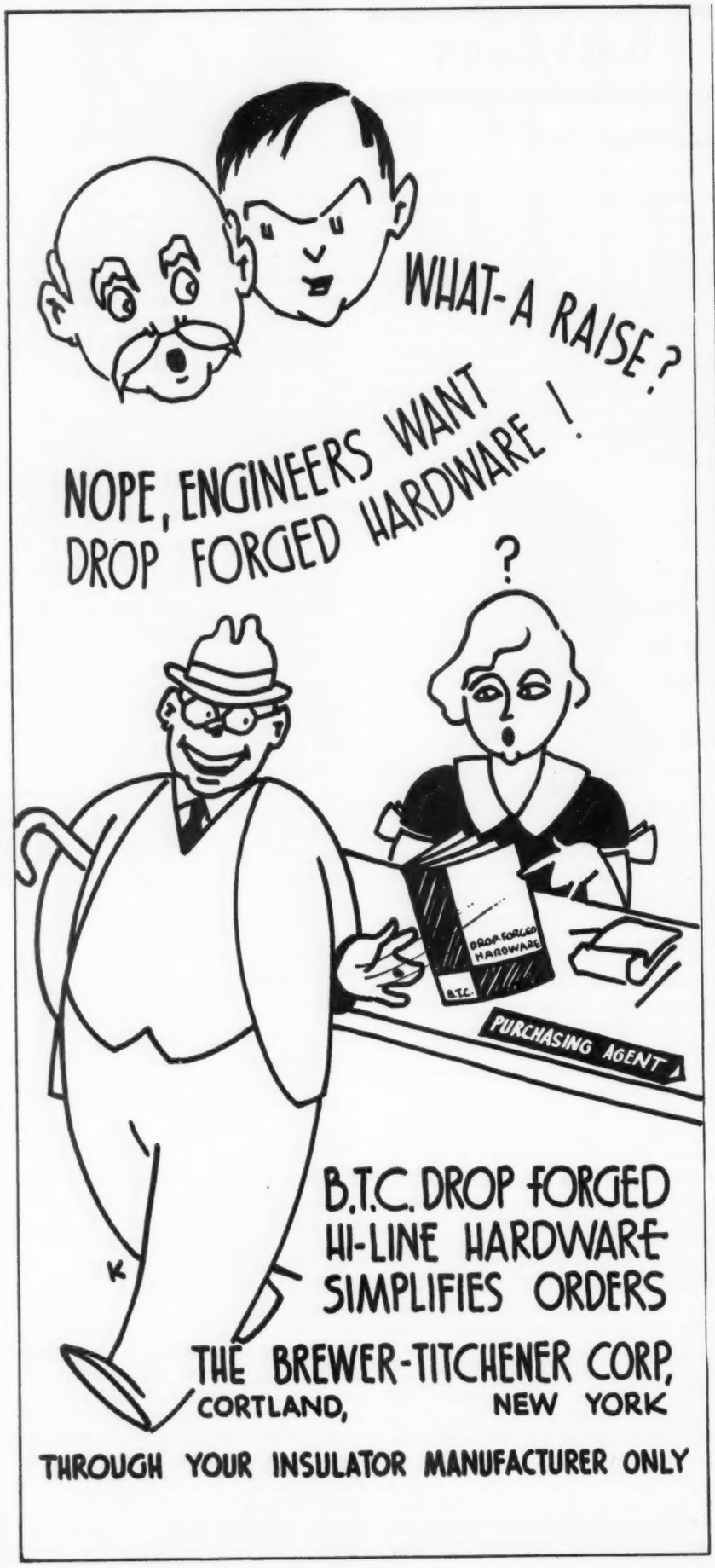
▶ CHARLES E. WETZEL, advertising manager of the United Gas Improvement Company, Philadelphia, was found dead on the morning of September 21 on a bank of the Little Lehigh River in a suburb of Allentown. Mr. Wetzel had been associated with U. G. I. since 1909 and had been advertising manager for the past four years.

▶ CHARLES H. HARVEY, chairman of the board of directors of the Tennessee Public Service Company, died at Knoxville October 6. Mr. Harvey, who was 73 years old, had been a public utility official for 40 years. Before that he had been for ten years in railway service. Since 1930 he had been chairman of the board of the Tennessee Public Service Company, a subsidiary of National Power & Light Company in the Electric Bond & Share system.

▶ DR. SAMUEL R. PRITCHARD, for 42 years professor of electrical engineering at Virginia Polytechnic Institute, dropped dead on the campus September 30, while walking to class. He was 72 years of age. For the past ten years Dr. Pritchard had been dean of engineering. He was a fellow of the American Association for the Advancement of Science and a member of the American Institute of Electrical Engineers and the Society for the Promotion of Engineering Education.

▶ DAVID HENNEY, a pioneer in the central station field of Connecticut, died in Upper Montclair, N. J., September 19 at the age of 83. He was a native of Thompsonville, Conn., and in his early career as an electrical engineer was president of the Hartford Power & Light Company until its merger with the Hartford Electric Light Company in 1882. Later he was connected with Westinghouse.

▶ CLYDE A. PRATT, formerly manager of the engineering department of the Electric Bond & Share Company in New York, died at his home in Stamford, Conn., September 27 in his fifty-ninth year. Mr. Pratt, who was born in Deerfield, Mich., moved to Columbus, Ohio, to organize war relief work and later was called to Washington and New York to organize a war relief clearing house for France and her allies. He was decorated by the French government twice in recognition of his work. After the World War Mr. Pratt became manager of the engineering department of the Electric Bond & Share Company. He also was president of the Phoenix Utility Company. He retired in 1932.



Recent Rate Changes

Georgia Power Company has been called upon by the Georgia Public Service Commission to show cause why industrial rates should not be reduced. J. P. Wilhoit, chairman of the commission, announced the hearing will be held on November 18. This nisi was issued at the request of cotton mills of the state.

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Rochester Gas & Electric Company's reduced electric rate schedule, which is expected to save residential customers $338,800 a year, has been approved by the state Public Service Commission. The approved cuts provide for reductions from 10 per cent for small users to 22 per cent for big customers. The minimum rate of $1 for 12 kw.-hr. is unchanged.

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Peoples' Power Company has been ordered by the Illinois Commerce Commission to reduce its electric rates for residential and commercial customers in Rock Island, Moline, East Moline, Silvis, Milan and adjacent territory. The reduction in residence electric service will result in savings to the residence customers of approximately $60,000 a year, which is approximately 10 per cent, of the company's gross revenue from this class of service. Similar reduction in rates are ordered for the commercial electric customers, approximately $36,000 a year, which is about 10 per cent of the company's gross revenue from this class of service. The new rates will apply to the rural customers served by the company except for the minimum. The proposed schedules of the Peoples' Power Company provide for a more liberal policy of rural extension. In these schedules the company proposes to finance rural extensions where the customers guarantee a monthly minimum of 2 per cent of the cost of the extension for a period of fifty months.

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Central Power & Light Company has reduced its residential and commercial rates in 150 towns in south Texas, the cut resulting in a total saving to customers of $438,803 during the last eighteen months. Room count and demand features of the former rates have been abolished in these new block rates.

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Bronx Gas & Electric Company and the Yonkers Electric Light & Power Company have carried their fight against Public Service Commission orders temporarily reducing rates to the Appelate Division, Third Department. Cuts of 10 per cent and 6 per cent respectively had been ordered by the commission in the rates of the companies, pending determination of a permanent schedule. Both utilities obtained stays of the orders until the final determination of the issue in the courts. The utilities contend the commission made arbitrary reduction in the rates and that its methods of computation and evaluation are unjust. The Yonkers company argues revenues would be cut $116,000 annually while the Bronx company set a figure of more than $400,000.

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New York Public Service Commission has announced the suspension until November 28 of the new rates of the electric companies of the Consolidated Gas Company of New York for auxiliary and breakdown service as a result of the petition filed by the Electric Plant Owners Association, Inc., protesting the new rates as arbitrary and unwarranted. The new breakdown and auxiliary rates were part of the general reduced rate program recently submitted by the companies and approved by the commission. Consumers complained that the new auxiliary and breakdown schedules called for larger payments, in many cases, than did the old rates in these classifications.

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LAMICOID *Laminated Bakelite Insulations*—Laminated Bakelite Sheets, Rods, Tubes, Fabricated Parts.

MICA *Insulations of other Types*—Untreated Papers, Varnishes, Linen and Silk Tapes. Fibre, Spaghetti Tubing, Cotton Sleeving, Raw Mica, etc.

Mica Insulator Company, 200 Varick Street, New York, N. Y.; 542 So. Dearborn St., Chicago, Ill.; 1276 W. 3rd St., Cleveland. *Branches at* Birmingham, Boston, Cincinnati, Los Angeles, San Francisco, Seattle. *Canada:* Montreal, Toronto.

Mica Insulator Company

COMPLETE INSULATION CATALOG—NEW PRICE LIST

(Mail to nearest office) Please send, without obligation on my part:— EW-10-12

☐ *Complete Insulating Catalog 87* ☐ *New Price List 98*

Name_____

Company_____

Address_____

Variable-Voltage Drive Boosts Gold Dredge Output

[*Continued from page 25*]

tered air. These characteristics, plus the absence of heavy vibration at this location, all contribute to great ease of maintenance and low maintenance costs, as well as a degree of safety comparable with that of a first-class industrial plant.

An independent 440-volt distribution board of the dead-front type occupies one end of the control room and takes its power from a 150-kva., 2,300 to 440-volt transformer bank housed in a fireproof compartment located on the main deck.

All resistor grids are of the unbreakable alloy ribbon type and are located in the hull compartment adjacent to the control room.

Instruments—Also typical of modern industrial plant control are the instruments with which the boat is equipped.

In the winch room are located indicating and recording buckets, per-minute meters and depth gages. The depth gage draws a curve of ladder depth against time and is operated by a Selsyn driven from the ladder hoist drum. In addition, the winch room is equipped with a swing bracket carrying all of the electrical instruments to which the operator needs to refer.

The instruments on the boat give a comprehensive record that permits of ready analysis of all operations.

•

Down to 0.8 Lb. per Kilowatt-Hour

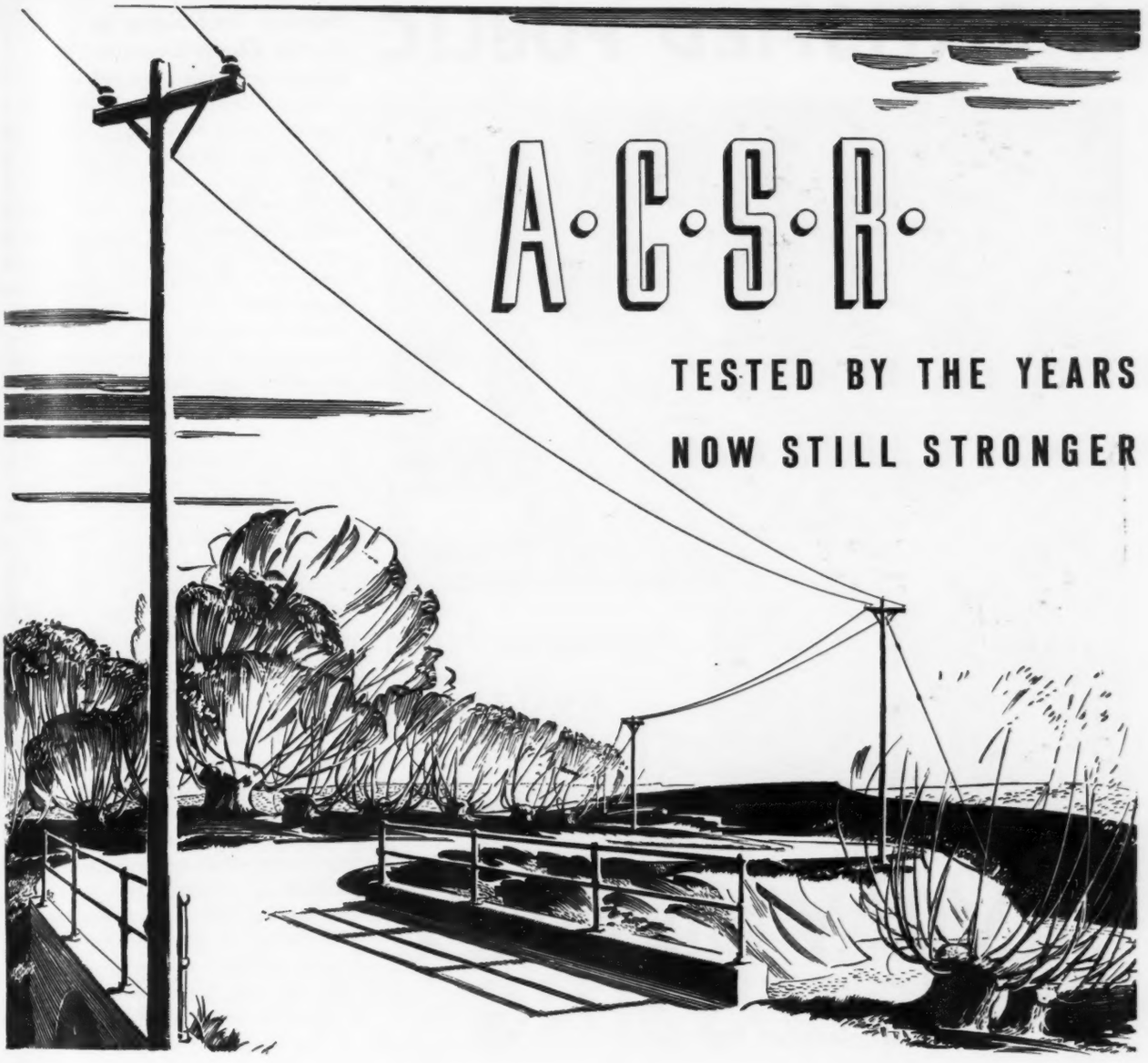
Improvements in the efficiency of utilization of fuel oil have been even greater than those achieved with coal. The rate of consumption of the former has been reduced by 24 per cent since 1926.

The U. S. Geological Survey has announced the following comparative fuel rates for coal, oil and gas, as determined from its monthly surveys of public utility power plants. For coal and gas the consumption is given in units per kilowatt-hour, for oil in kilowatt-hours per barrel.

	1926	1931	1934
Coal, lb./kw.-hr. ..	1.94	1.55	1.47
Oil, kw.-hr./bbl. ...	243	329	353
Gas, cu.ft./kw.-hr. .	22.2	16.9	17.0

Some of the regional averages are much better than the national, the best for coal for 1934 being 1.32 lb. in the Middle Atlantic, for gas 13.9 cu.ft. in the Pacific, for oil 368 kw.-hr. per barrel in the Middle Atlantic. The best fuel rates in 1934 are stated to have been about 0.8 lb. of coal and 11.0 cu.ft. of gas per kw.-hr., and 450 kw.-hr. per barrel of 42 gallons of oil.

The theoretical heat value of a kilowatt-hour of energy is 3,411 B.t.u. Since the best steam plants can produce a kilowatt-hour from about 10,500 B.t.u. the over-all efficiency is about 33 per cent, the Survey points out.



A·C·S·R·

TESTED BY THE YEARS
NOW STILL STRONGER

● The years have proved the superior reliability that derives from the high strength-weight ratio of A.C.S.R.

Now, 8-strand A.C.S.R. is available for rural lines. This stranding of 7 Aluminum over 1 steel increases strength by 25%, so that spans can be materially lengthened without increasing stresses beyond reasonable and safe values.

There you have, tied together inescapably, the two important advantages of A.C.S.R.; low line cost and sound reliability.

Add further this fact: on flashovers, the steel core, in which is 60% of the strength, is always protected. Add further the fact that the arc is unstable on the Aluminum strands, and that they do not burn deeply.

Fittings? They're interchangeable, because of the inconsequential increase in O.D. of the new stranding over the equivalent 7 strand cable.

More than ever, A.C.S.R. is economy, first and last. May we send you our complete data on this new stranding? ALUMINUM COMPANY OF AMERICA, 1838 Gulf Building, Pittsburgh, Pa.

ALCOA ALUMINUM

A SATISFIED PUBLIC

—results from *better* STREET LIGHTING..

SILVRAY "MULTIPLEX" PROCESSING

—OFFERS AN *Economical Means* of Improving Street Illumination

How? Because it now enables the Utility to place before Civic Authorities a proven plan for an increase in effective illumination ranging from 30% to 50%, at an additional cost about the same as the present cost of street lamp renewals.

Silvray "Multiplex" Processing gives controlled and directed light without the use of separate reflecting devices.

Silvray "Multiplex" Processing Controls and Directs the Light Rays to meet Street Lighting Requirements.

Write for further information or have one of our engineers call with reference to a Survey or Recommendations—without obligation.

"Adequate Street Illumination Pays Permanent Dividends"

AMERICAN STREET ILLUMINATING COMPANY

"Backed by 57 Years' Street Lighting Experience"

261 NORTH BROAD STREET . . PHILADELPHIA, PA.

Survey Technique in Rural Electrification

[*Continued from page 29*]

their qualifications as salesmen, without, however, having anything to sell. Their work consisted in calling on the prospects and obtaining sufficient information regarding their circumstances to permit an appraisal of the type of customer who would be interested in electrification. These "rural inspectors," as they were called, were carefully instructed in their approach to the rural dwellers and were coached to avoid any statements tending to give an idea as to who would build extensions and as to when the construction would take place. Full information on the appliances which the prospect would expect to purchase during the first year of operation of the extension was sought in each case. Complete replies to inquiries were obtained from about 80 per cent of the calls. The men averaged 30 interviews per 35-hour week. Data were obtained by mail so far as possible in cases where personal contacts were missed.

In the headquarters a staff of electrical engineers under a supervisor of engineering prepared cost estimates of extensions based on the field information, and a statistician assembled figures. A drafting force under a chief draftsman prepared the final county maps used in the report of the project, but the major portion of the drafting work consisted of the preparation of final record drawings for each individual extension, showing location and listing major materials.

The number of employees varied from week to week (the work extended from February to September), with an employment peak of 156 persons. The average experience of the project employees was eleven years. A number of young college graduates were included in the various field parties and the parties traveled about 160,000 miles in the survey. The survey developed extensive data pointing to the initial construction of 1,168 miles of extensions averaging 2.4 miles each, covering 5,474 potential customers, representing an estimated line, transformer and service wiring cost of $2,024,549, an annual revenue from energy sales of $215,847, a customers' wiring cost of $730,760 and initial appliance outlay of $614,370. The cost of the survey was about 2 per cent of the estimated total capital cost of lines, wiring and appliances, or, roughly, $66,000.

"ears eyes nose"

Bristol's Recording, Control and Indicating Instruments are, so to speak, the "ears, eyes and nose" that see and detect everything you want to know. Let these dependable faithful helpers (a few of which are shown here) tell you constantly, accurately what's going on in your plant. They not only will stop your fretting, but also save you plenty. The Bristol Company, Waterbury, Conn. *Branches in principal cities.*

Flow Meter

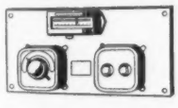
For indicating, recording, controlling, integrating flow of steam, air, gases, liquids. A rugged, reasonably-priced mechanical flow meter that under severe field conditions can be counted on to give precision measurement. Compensates for line pressure. Records rate of flow, line pressure and temperature. Bulletin 425.

Metameter

For telemetering pressure, liquid level, temperature, motion. Twelve-inch chart at headquarters records instantly every fluctuation in steam pressure, voltage, or level occuring a few feet or a thousand or more miles away. Simple two wire circuit or existing telephone line. Bulletin 424.

Electric Indicating Thermometer

For taking temperatures at any number of distant places. Indicates temperature with precision accuracy. The measuring elements or resistance bulbs are interchangeable. Bulletin 997.



Full Floating Free Vane Air-Operated Recorder Controller

Device utilized for effecting temperature or pressure control floats from one position to another. It does no mechanical work. It encounters no resistance or friction. Indications are accurate. There is no distortion. Catalog 4001.

Synchro Automatic Control Valve

Diaphragm operated, V port balanced type. For a given air pressure on the diaphragm top, position of the valve opening is the same, whether pressures are rising or falling. There is no friction loss. Response is instantaneous. Bulletin 938.

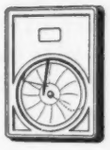
Thermo-Humidigraph

Or direct reading temperature and relative humidity recorder. Eliminates calculation and use of humidity tables. Eliminates personal errors. No water or fan required. Accurate below freezing temperature. Light portable case of corrosion-resisting materials. Bulletin 413.

Pyrometer Controller

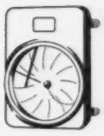
For ranges up to 3000°F. Clean non-arcing mercury-to-mercury electric contacts sealed in glass. No relays. Operating mechanism visible. Accessible telechron motor, mercury switches, terminal block. Simplified field inspection. Safe. Simple rugged working parts. Bulletin 389.

Recording Absolute Pressure Gauge



As easy to read as a clock. Furnishes continuous 24 hour record of absolute pressure automatically corrected for barometric variations and temperature changes. Supplied for ranges as low as 0 to 50 millimeters head of mercury column. Bulletin 401.

Fully Compensated Liquid-Filled Thermometer

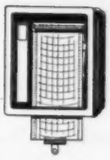


Charts accurately the temperatures to which the sensitive bulb is subjected. Neither a long length of connecting tubing nor disturbing temperature conditions along the tubing can impair its precision performance. Bulletin 1002.

Recording Voltmeter

For furnishing continuous records of voltage fluctuations in transformers, primary voltages at power houses, secondary voltages at consumer's premises, voltage output from emergency storage batteries, incoming voltages at manufacturing plants. Catalog 1502-V.

Recording Ammeter



For furnishing continuous records of initial inrush and operating currents under variable load conditions. Used in connection with power and lighting circuits, substation buses, transformers, grounded neutral, motors, electric furnaces, ovens, signs. Bulletin 1502-A.

Recording Wattmeter

Records load conditions and power consumption of generators, motors, transformers, and electrically-driven machinery. Also records peak loads, central station output, input to mill, load of each building or department. Bulletin 1502-W.

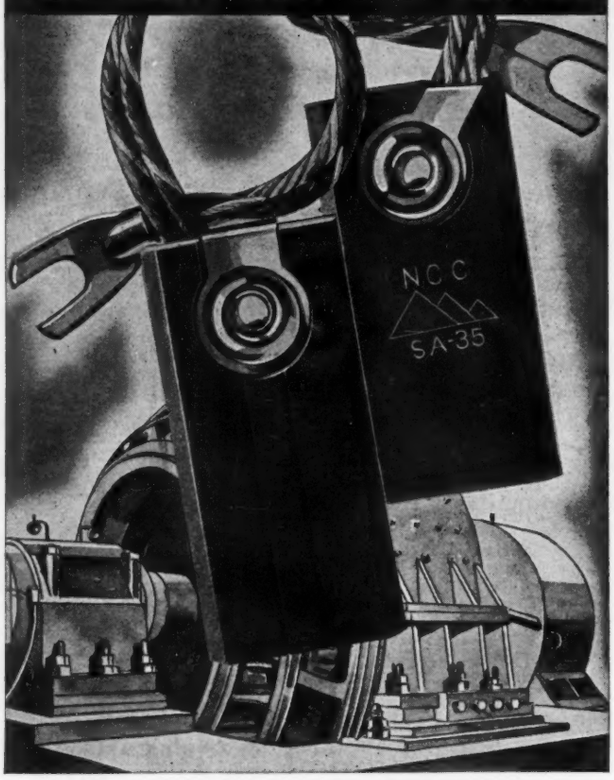
BRISTOL'S

TRADE MARK REG. U. S. PAT. OFF.

PIONEERS IN PROCESS CONTROL SINCE 1889

UNIFORMITY

IS THE OUTSTANDING CHARACTERISTIC OF
"SA" SERIES BRUSHES
FOR HEAVY DUTY D. C. SERVICE



In addition to the regular trade marks—the Three Pyramids, the Silver Strand Cable and the Grade Number—these new grades are further identified by the Double Engraved Lines (Trade Mark Registered) down the center of the brush.

THE exceptional uniformity of "SA" Series brushes—uniformity in performance as well as in physical properties—marks a definite advance in brush manufacture. It eliminates the brush variable from machine performance.

These new electro-graphitic brushes, SA-25, SA-30, SA-35, SA-40, and SA-45, are progressively graded in commutating properties and cover a wide range of application on heavy duty equipment.

Write for specific recommendation for your heavy duty D.C. service.

NATIONAL CARBON COMPANY, INC.
Carbon Sales Division, Cleveland, Ohio
Unit of Union Carbide UCC and Carbon Corporation
Branch Sales Offices:
New York · Pittsburgh · Chicago · San Francisco

Effective Ways to Stop Energy Diversion

[*Continued from page 33*]

partment for a service man to come out, break the seal, renew the fuse and reseal the box. Not every customer has a telephone nor access to one. Besides, the strict enforcement of sealing increases costs to the company in more service calls and prolonged outages and is inconvenient to the customer in the delay of arrival of the service man. New sequence, of course, obviates all these difficulties.

The U-jumper prevention devices are seen to be effective for only a short time, after which, apparently, some other means than the U-jumper are employed. The tamperer is able to carry on his energy diversion without the breaking of seals to reveal his practice.

A separate investigation was made on 217 customers suspected of tampering in order to check the effectiveness of meter connection boxes and U-jumper prevention devices. Monthly kilowatt-hour readings were listed for each customer for several months before any changes were made. On 76 of these customers' installations meter connection boxes were installed in new sequence, metal-inclosed service. On the remaining 141 installations U-jumper prevention devices were installed. The kilowatt-hour readings were kept for several months thereafter.

The effectiveness of the connection boxes in reducing diversion is shown in the following figures:

Type of Customer	—Average Monthly Kilowatt-Hours per Customer— Before Installing Boxes	After Installing Boxes	Per Cent Increase
1. Residence.....	40	53	32
2. Small commercial...	135	219	62
1 and 2 combined.....	65	97	49

From the 141 customers on whose installations the U-jumper prevention devices were installed it was found that this method of reducing energy diversion was not very effective. Therefore, it was not considered worth while to carry out the analysis as was done above for the meter connection boxes. The same condition as was found in the original field study was found in this investigation, namely, that for a short time after the installation of the U-jumper prevention devices energy diversion was apparently checked, as was evidenced by increased registration, but soon the registrations decreased again in most cases, indicating resumption of energy diversion.

● **Here's a new Wire Grip by Crescent that *takes hold* and *hangs on* - yet *cannot* injure wire. Combines all the best features of Crescent's famous Buffalo Grips and Haven's Clamps and adds *many more*! Easily released by a flip of the rope. Absolutely jam-proof. Extremely lightweight for its capacity. Hook prevents it dropping from wire and injuring workmen below.**

All parts are of forged steel, heat-treated for uniform strength and finished in Cadmium Plate. Ask your supplier for the new Crescent Wire Grips. You'll find them equally efficient on bare or insulated wire. Two Sizes:

	Safe Load	*Weight*
No. 383-Max. Open'g ½" Min. Open'g 3/16"	**5,000 lbs.**	**2 lbs.**
No. 385-Max. Open'g 13/16" Min. Open'g ⅜"	**10,000 lbs.**	**4¾ lbs.**

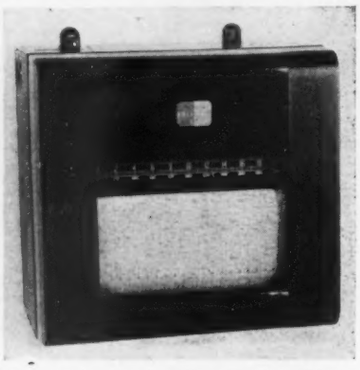
CRESCENT TOOL COMPANY - - - JAMESTOWN, N. Y.

CRESCENT and Smith & Hemenway TOOLS

NEW EQUIPMENT

Potentiometer Pyrometer

Operates on the potentiometer principle of temperature measurement with its inherent advantage of freedom from error due to change in resistance of the couple or lead wires. An induction-type motor under direction of two galvanometer-controlled contacts operates the lead screw which adjusts the slide-wire contact to maintain emf. balance in the potentiometer system. Design of the potentiometer system permits magnification of slight galvanometer deflections.



Uses 12½-in. strip record and also 1¼-in. indicating scale; described in catalogue 1450. **The Bristol Co.,** Waterbury, Conn.

•

Industrial Circuit Breaker

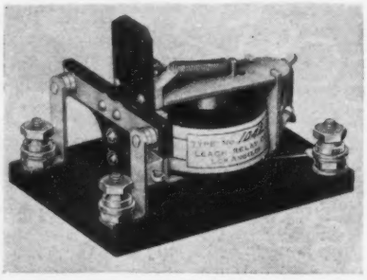
Industrial circuit breakers of this make are now made with the swing-out interior feature. The breaker unit is mounted in a metal pan hinged to the box. Thus, it can be swung out away from the box to permit access to the interior for wiring. Since the operating and breaker handle are permanently engaged there is no danger of breakage when cover is being closed.

Available in sizes from 15 to 50 amp., 250 and 575 volts, a.c.; 2 and 3 poles. **Square D Company,** Detroit, Mich.

•

Overload Trip Relay

This relay is for use primarily as a safety device on various types of apparatus for the protection of the equipment against excessive current. When the current passing through the coil reaches a predetermined value the armature is pulled in, allowing the contacts to snap open. At the same time the armature is locked in a closed position. To reset the contacts the coil circuit must be opened before pressing the reset finger. This device can be used as a circuit breaker by connecting the coil and contacts in series.

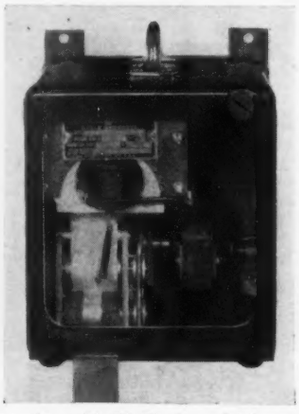


Available to trip on currents from 25 milli-amp. to 2 amp.; contact ratings available, 5 and 10 amp. on 115 volts. Leach Relay Co., Los Angeles, Cal.

•

Cycle Recorder

For giving pictorial evidence of the time during which current flows in any a.c. circuit, this cycle recorder is especially suited for use with resistance welder timers. It provides a means of calibrating or adjusting the timers, of producing a record of weld time and it also aids in duplicating welds previously found satisfactory. The device is oscillographic in nature. A polarized reed, driven by a coil which surrounds it, carries a stylus which presses on a moving strip of thin paper under which rotates a graphite roll.



Dimensions 5½x7½x7½ in.; driving coil tapped for use at any of five amperages. **General Electric Company,** Schenectady, N. Y.

•

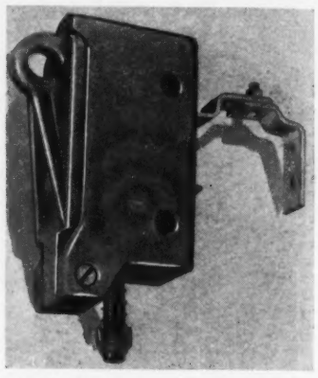
Insulating Compounds

"Self-Vulc" and "Air-Vulc." **Self-Vulcanizing Rubber Co.,** Chicago.

Plastic and liquid self-vulcanizing rubber compounds are now available for electrically insulating the handles of linemen's and other tools. Further application is found in the treatment of scaffold and raised truck platforms to give extra insulation protection.

Indicating Fusible Cutout

Fuse outage is indicated by this cutout with the appearance (as shown) of the fuse cartridge in a telltale position. Rupture of the fuse releases a latch which holds the cartridge in position against spring pressure. Action of the spring forces the cartridge through a hole in the bottom of the box and also breaks its contact with the top clip, providing air-break separation. Indication and circuit disconnection are accomplished without exposing the box to weather. By inserting the proper fuse holder or disconnect blade the cutout can be changed from indicating to non-indicating or straight disconnect switch.



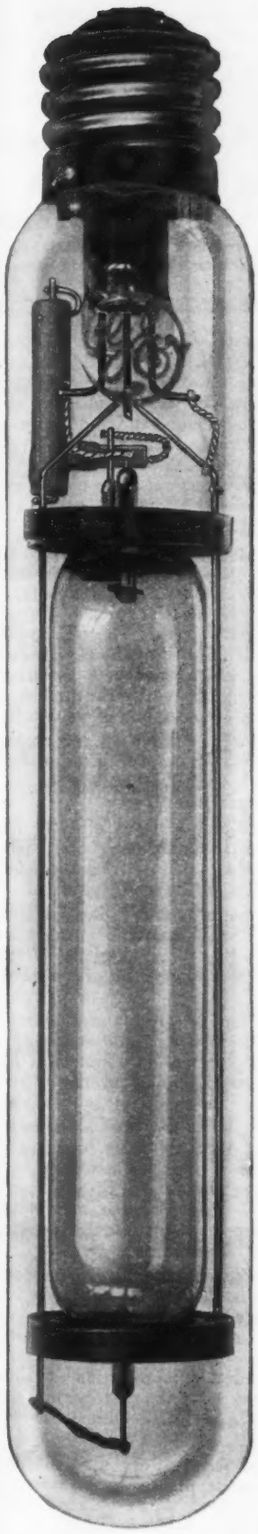
Available in two ratings for 5,000 or 7,500 volts; wet process porcelain door and box. **Porcelain Products Inc.,** Parkersburg, W. Va.

•

Sound-Level Meter

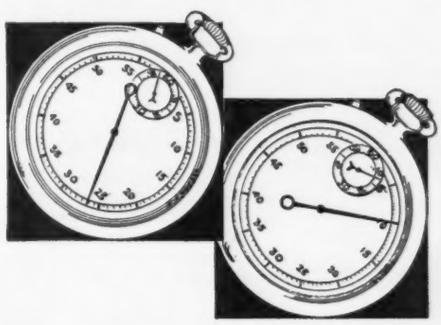
This portable, self-contained noise meter is used in making noise surveys where the ability to make rapid readings is required. Response to various frequencies and pitches is similar to that of the human ear, so measurements will be proportional to a person's impression of loudness. The microphone, of a new type, is mounted in the face of the carrying case, which incloses a two-stage amplifier, designed to be rugged and foolproof. A range of 18 db. is included in the indicating meter, while a "multiplier" or attenuator is supplied to give a comprehensive total range.

Type RA-198; dimensions 8¾x5¼x4¼ in. **Electrical Research Products, Inc.,** New York City.



Quicker
VISUAL RESPONSE

saves time and promotes safety



Details unseen under other types of commercial lighting are clearly *and quickly* visible under the new General Electric High-Intensity Mercury Vapor Lamp. Long hours of work under this light produce no eye-strain. Excessive contrasts between light and shadow are eliminated. What few shadows there are, are luminous.

Greater lighting efficiency—more lumens per watt—is one of the inherent qualities of the G. E. High-Intensity Mercury Vapor Lamp. In fact, the lamp costs less to operate than ordinary light on the basis of light emitted per watt of power.

Full details are contained in a sixteen-page booklet which can be secured by writing the General Electric Vapor Lamp Company, 805 Adams Street, Hoboken, New Jersey.

GENERAL ELECTRIC VAPOR LAMP COMPANY

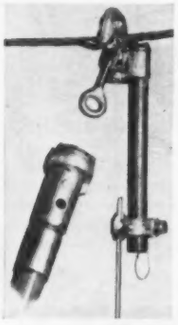
Order your auxiliary devices which were designed especially for this lamp from the General Electric Vapor Lamp Company.

HIGH INTENSITY
Mercury Vapor Lamp

657 Copr. 1934, General Electric Vapor Lamp Co.

Fused-Tap Cutout

Designed primarily to provide inexpensive fuse protection for the new rural line transformers, this device consists of a "snap tap" clamp supplied with an attachment for holding a fuse. Attached directly to the "hot" wire with a clamp or switch stick, it eliminates the necessity for brackets or crossarms to support it. A mechanical connection is supplied to hold the tap wire leading to the transformer.

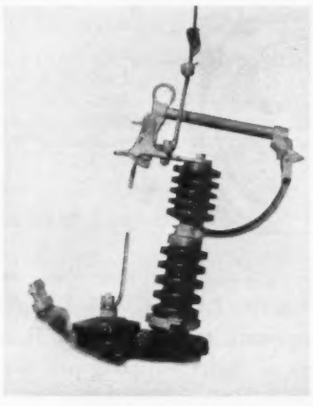


"Fused tap clamp," for voltages to 13 kv.; furnished for copper or aluminum conductors; uses standard fuses. **Tips Tool Co.**, Taylorville, Ill.

•

Cutout for Rural Transformers

Mounted directly on the single, high-tension bushing of the new type rural transformers, this device provides fuse protection for the transformer and gives ground gap protection against lightning. When the fuse blows the cartridge swings to the vertical position, giving indication of outage. The fuse is renewed by lifting the cartridge off its hinged point. Re-fused, its flared socket is dropped back over the point and the swing end pulled down to its latch.

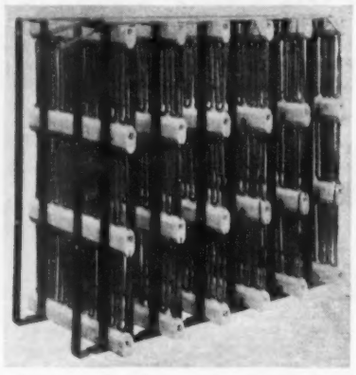


"Fuzette" available in sizes for 5,000, 7,500 and 15,000 volts. **Southern State Equipment Co.**, Birmingham, Ala.

•

Air Heating Unit

Using folded and formed elements, this heating unit was developed for use in an industrial air-heating system to develop temperatures up to 150 deg. F. It is said to be unique in that it was used for such a low air temperature. This form of heating element is claimed to give the lowest value of temperature gradient when compared with other elements. Since this unit should not run at high temperatures, elements were designed to use 2¾ watts per square inch.

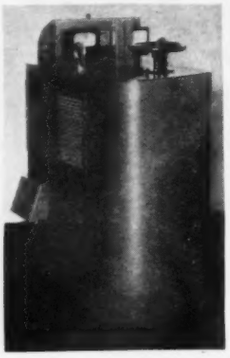


Unit rated at 12 kw., 230 volts, 3-phase. **Harold E. Trent Co.**, Philadelphia, Pa.

•

Transformer Type Welder

Automatic control is a feature of this single-operated a.c. welder. When the operator stops work the control cuts the machine off the line. Operation is resumed by pressing a switch in the holder. A welding range from 100 to 500 amp. is said to meet the need for relatively high current values for speedy production work.

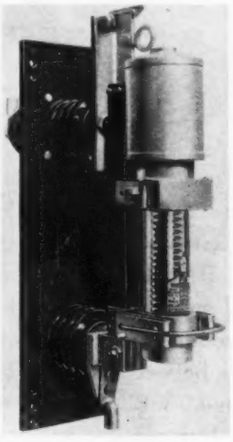


Smaller transformer type a.c. welder, range 30 to 150 amp. on 110 or 220 volts, also announced; large welder illustrated. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

•

New Type C Fuse

Suitable for substations, industrial plants, cubicles and confined space applications where blowing of standard expulsion type fuses might cause damage, this fuse has an accurate fuse element and is used with a heavily constructed arcing chamber and condenser chamber at the top of the tube. Visual inspection of the fuse is permitted by the glass tube.

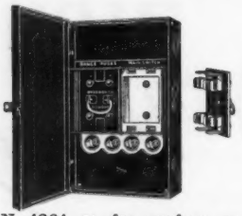


Capacity range ½ to 400 amp. for 7.5-, 23- and 34-kv. systems. **Schweitzer & Conrad, Inc.**, Chicago, Ill.

•

Service Entrance Device

This equipment is provided with two "Renu-Fuse" pull-cover units. One unit is for the main switch and fuses, while the other is for range disconnect and fuses. Two terminals for water heater connection, with either two, four or six lighting circuits, are provided. Contacts of the pull-cover units are made on the outside of the fuse well. Dead front is removable without disturbing circuits or removing pull covers.



Type N 4264 s; for surface or flush mounting; lighting circuits in either top or bottom of cabinet. **Wadsworth Electric Mfg. Co.**, Covington, Ky.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

"Cable Accessories," a recent General Electric bulletin (GEA-1839) describes and lists in 78 pages all the materials required for cable jointing. A large number of section drawings are included which depict various types and kinds of power cable joints. Another bulletin (GEA-2113) devotes 10 pages to the discussion of cable compounds for insulating and sheathing of cables. A tabulation of specifications is included.

Two research papers on thermocouples are now available, for sale ($0.05) by the Superintendent of Documents, Washington, D. C. Standard tables for chromel-alumel thermocouples are given in paper RP. 767, while paper RP. 768 deals with methods of testing thermocouples and thermocouple materials. Both papers are published by the Bureau of Standards, U. S. Department of Commerce.

Copperweld wire specifications and characteristics are tabulated on specification leaflet S-35, available from the Copperweld Steel Company, Glassport, Pa.

Characteristics and features of rural line transformers are tabulated in a recent 4-page publication obtainable by writing the Kuhlman Electric Company, Bay City, Mich.

Construction features and rating specifications of type VS air compressor units are detailed in bulletin L-621-B7A of the Worthington Pump & Machinery Corporation, Harrison, N. J.

Simplified Practice Recommendations—Carbon Brushes and Brush Shunts—compiled by the Department of Commerce, Bureau of Standards, are now available from that department for approval by the electrical industry. Designated as R56-35.

Metallurgy of Oxy-Acetylene Welding of Steel is the title of a release available from Linde Air Products Co., 205 E. 42d Street, New York City. The release is an abstract of a paper presented before the International Acetylene Association.

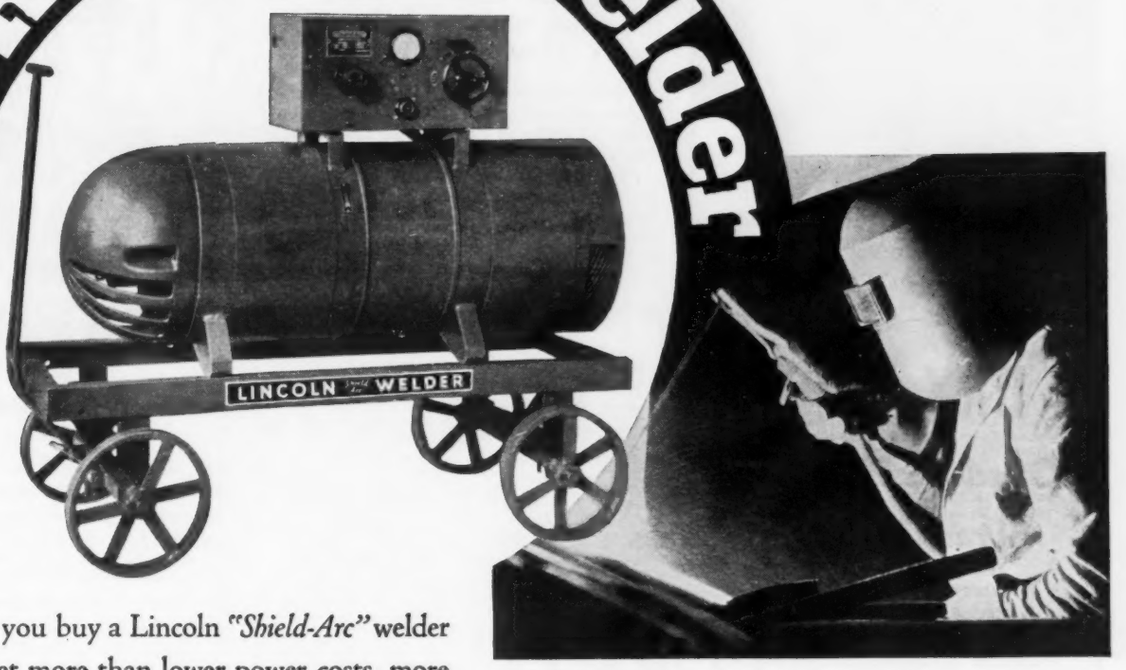
Relays for radio, telegraph, telephone and broadcast circuits, power houses, alarm systems, heating systems and the like, are described in catalogue 1-A of the Leach Relay Company, Los Angeles, Calif. Operation of the relays and their application are illustrated by means of numerous wiring diagrams. Specifications and dimensions are tabulated.

Operating principles of dual control liquid coolers are explained and illustrated in pamphlet No. 3352 of the Larkin Refrigerating Corporation, Atlanta, Ga.

Data to assist in planning indirect lighting are included in a recent 26-page publication of the Curtis Lighting Company, Chicago, designated as handbook "H," series 808.

"Correct Anchoring," a booklet containing information on methods of anchoring pole lines, is available from A. D. Chance Company, Centralia, Mo. It explains advantages of patent anchors, describes different types, their uses and holding power. Data, formulas and tables are included that may be applied to solution of any usual problem in pole line construction.

MORE than a Welder



WHEN you buy a Lincoln *"Shield-Arc"* welder you get more than lower power costs, more than lower electrode costs, more than lower labor costs, more than highest quality welding.

At no extra cost you share in many other important advantages which only users of Lincoln welders can receive.

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LAD: "Let's talk about welding, Pop. Lincoln says it takes more than a good welder to get all the profits arc welding offers. That's why they give us so much more than the *'Shield-Arc'*."

THE LINCOLN ELECTRIC CO., Dept. U-178, Cleveland, O.

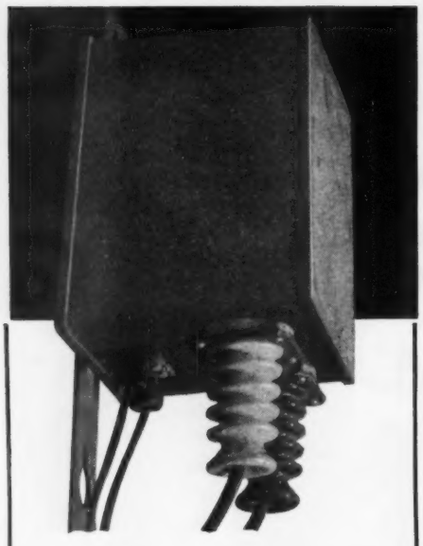
Gentlemen: Please send full particulars on *"Shield-Arc"* welding.
I now weld with (check which) ☐ electric arc ☐ gas ☐ none

Firm .....

Your Name ..... Title .....

Address .....

City ..... State .....



DRY-TYPE

Outdoor Potential Transformers

Greater mechanical and insulation strength is one of the outstanding features of the new Westinghouse type PTO outdoor potential transformers.

The high insulation strength results from winding the primary coils on Moldarta spools and from a newly-perfected process for filling and impregnating with a high-strength insulating compound.

The all-welded sheet steel case forms a sturdy, moisture-proof container.

Additional features are:

1. **Coordinated insulation**—Surges flash over the bushings and thus cannot harm the windings.

2. **High accuracy**—The ratio changes less than one per cent from zero to full load. Transformer is so compensated that from zero to 50% of nameplate rating the ratio error will not be more than ¼ of one per cent.

3. **Long life**—Transformer case is solidly filled with a new insulating compound that will not deteriorate with age.

Type PTO transformers are available in ratings up to 13,800 volts.

R 59017

Westinghouse

DRY-TYPE TRANSFORMERS

High Frequency for High-Speed Motors

[*Continued from page 35*]

tors for high-frequency service are therefore standardized for three-phase and certain frequency series, corresponding to the series of the converters. These are:

Normal-frequency series, based on 60 cycles at 220 or 440 volts—Frequency range, 60 cycles at 220 volts, up to 100 cycles maximum at 367 volts.

First high-frequency series, based on 120 cycles at 220 or 440 volts—Frequency range, 120 cycles at 220 volts, up to 199 cycles at 367 volts or down to 60 cycles at 110 volts, or 120 cycles at 440 volts up

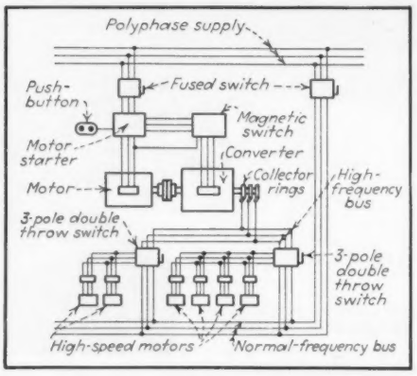


Fig. 4 — Connections for operating motors on high or normal frequency

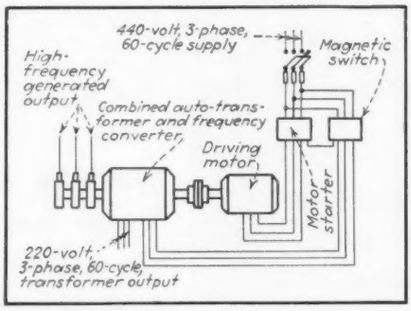


Fig. 5—Combined auto-transformer and frequency converter

to 150 cycles at 550 volts or down to 60 cycles at 220 volts.

Second high-frequency series, based on 200 cycles at 110 volts—Frequency range, 200 cycles at 110 volts, up to 540 cycles at 297 volts, or down to 180 cycles at 99 volts.

Portable-hand-tool series, based on 180 cycles at 220 volts.

If a motor is to be operated on two frequencies it should be chosen for the maximum frequency. If based on 120 cycles, it will operate on 60 cycles at one-half rated output.

In the choice of motors to run on the higher frequencies, the ultimate voltage must be taken into considera-

Coolies Roast Seeds

From the seeds of an oriental tree . . . comes one of the most important ingredients of insulating varnish, Chinese Tung Oil. Its importance can be measured by the fact that millions of pounds are sent to the United States every year. Coolies gather the Tung seeds, roast them in flat dishes over open fires, and after coarsely powdering them, squeeze out the oil in crude wooden presses

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Research has brought to light many curious as well as valuable facts about materials for electrical insulation. And, for 50 years, Westinghouse has maintained constant research to develop the finest possible insulation. Westinghouse insulating materials are made to keep your equipment on the job. Make your insulation dependable . . . specify Westinghouse. Send for new booklet C-2033, "Making Insulation Fit the Job." Address Westinghouse Electric & Manufacturing Co., Dept. 100, East Pittsburgh, Penna.

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INSULATING MATERIALS

R-89007

tion so that prohibitive voltages may not be encountered. A motor to run at 10,800 r.p.m. could be secured by operating one built for the 120-cycle, 440-volt series on 180 cycles, but since the voltage increases in the same proportion as the frequency this would involve an ultimate voltage of 660, which is in excess of the allowable voltage for low-voltage installations. We would therefore select a motor built on the basis of 120 cycles, 220 volts, which, at 180 cycles, would require 330 volts, which is acceptable in general practice. The limiting frequency for motors of the 120-cycle, 440-volt series is 150 cycles, at which frequency the output voltage is 550. The voltage of the converters must, of course, agree with that of the motors with which they are employed.

In some classes of work it is desirable to operate machines at different speeds for varying kinds of service. At times we may wish to run the motor at 3,600 r.p.m. on 60 cycles, while at other times it should run at, say, 6,000 r.p.m., requiring 100 cycles. The arrangement given in Fig. 4 shows how any group of motors may be changed from high frequency to line frequency.

Where the supply line is 440 volts, and some motors must operate at 220 volts and others at high frequency, both can be served by a converter combining the functions of frequency changer and auto-transformer. Such converters have an additional circuit to provide 220-volt, 60-cycle power, and leads are brought to the terminal board so that connections may be made as shown in Fig. 5. However, it should be borne in mind that the total power drawn from the unit should not exceed the total rating of the converter. If half the converter capacity is being taken through the auto-transformer, the power that is taken from the collector rings will be reduced a like amount.

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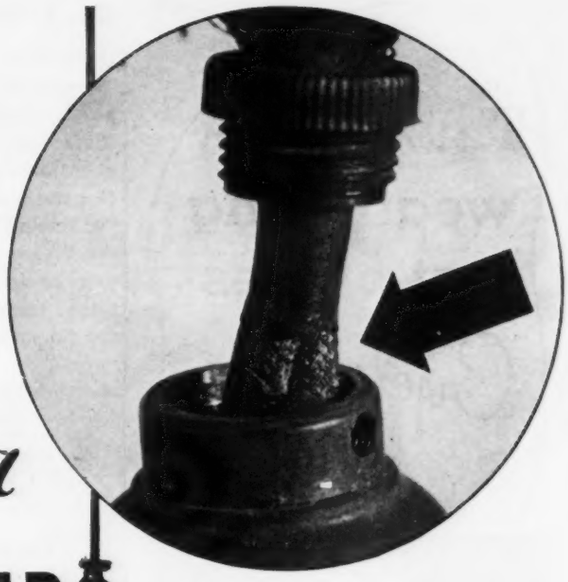
Line-Post Insulator Development

In the article entitled "Line Post Insulators Prove Worth on 66-kv. Line," in the August 3 issue of ELECTRICAL WORLD, there appeared on page 32 the statement: "This manufacturer had been conducting similar tests at his plant during a period of a year or more previous and the results confirmed his own findings." This sentence should not have been attributed to the author, Mr. Doolittle.

Let's have a **CLOSE-UP** *of that* **WIRE FAILURE**



Picture of an accident about to happen! Rubber insulated cord of fixture to the left as it appeared with braid rolled back and bushing removed. Notice how outer belt of rubber has dried up, cracked and fallen away leaving conductor insulation unprotected from abrasion.

"No light, eh? Probably the same old story—a short in the cord at the bushing. Cord on chain pull pendants certainly has to take a lot of abuse where it enters the socket. Let's have a look at it—yes, there it is; rubber insulation heat-dried, broken, fallen apart and unprotected conductors chafed bare." It's a familiar story, often the sequel of the insulation condition illustrated above.

Recently, just such a failure crashed a pendant into a delicate piece of machinery and the cost for repairs ran into thousands of dollars. An unusual case, perhaps, but every day ordinary cord is failing because of deterioration caused by lack of immunity to heat. Sockets do get *hot*. Shade design, wattage and other factors increase temperature in the socket 50 to 100° over ambient. Under these baking temperatures ordinary insulation soon becomes dry and brittle, then cracks, opening the way for failure.

Yet you can eliminate a good percentage of your lighting fixture maintenance if you will use wires and cords insulated to stand this heat condition. We refer, of course, to Rockbestos Heat Resisting Flexible Cords and Fixture Wires! The insulation of these wires is non-deteriorating, heat-resisting asbestos, impregnated and compressed into a dense felted wall, having ample dielectric strength and moisture resistance—greater mechanical strength—and permanent flexibility. Let us send you a sample that you may see these characteristics for yourself. Use the handy coupon. Rockbestos Products Corporation, New Haven, Conn.

ROCKBESTOS
—the wire with permanent insulation

Rockbestos Products Corporation, New Haven, Conn.
Send me a sample of Rockbestos Heat Resisting Flexible Cord and your catalog.

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This super-weathering test proves Cyclone quality
Cyclone fence stands 12 Preece test dips
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ORDINARY FENCE

● There *is* a yardstick of fence quality—a test that proves in a few minutes the real value of any fence fabric.

It is the impartial Preece test, recognized by the U. S. Bureau of Standards, which gives chain link fence fabric a quick weathering action equivalent to years of exposure. In this test, Cyclone 12-m fence is guaranteed to withstand a minimum of *twelve* one-minute immersions. This is two to three times as much as ordinary fence can stand.

Before you buy any Chain Link fence, submit it to the Preece test. Then make your selection. All Cyclone Chain Link fence bears the Cyclone 12-m seal as our guarantee that every foot will meet this extremely high standard.

Every prospective purchaser of fence is invited to mail the coupon for the famous Cyclone book—"Fence—How to Choose It—How to Use It". It tells how to get *more* for your money.

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Please mail me without obligation a copy of your book, "Fence—How to Choose It—How to Use It."

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United States Steel Corporation Subsidiary

Gas Testing of Cable Sheaths

[*Continued from page 37*]

the top of the tool. When once applied, these devices are left on the cable until the location of the fault is determined. They are then removed and the holes in the sheath sealed.

Pressure readings are now taken at the temporary valve locations and a new pressure curve is plotted to a rather large scale. The intersection of the extended pressure gradients should

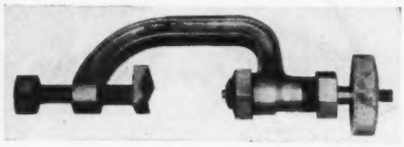

Fig. 5—Valve for detail test

now indicate quite accurately the location of the fault.

In taking pressure readings at permanent and temporary valve locations every effort is made to avoid factors which might adversely affect the dependability of the pressure curves. As the pressure within the cable under test is constantly varying because of atmospheric temperature changes and because of a certain amount of gas escaping through the fault or faults which are being sought, the readings are taken simultaneously where practicable. Where this procedure is not practicable, readings at several adjacent locations are taken simultaneously and the readings obtained correlated in plotting with those obtained at the next group of locations.

Even where the above precautions are taken, it may not be possible to obtain an accurate location of a fault from the pressure curves. This condition is usually only encountered where the leak in the section of cable is extremely small or where multiple faults exist in the section under test. In such instances use of the mercury manometer is abandoned and the differential pressure meter shown in Fig. 6 is used. This instrument is essentially an inclined manometer employing a liquid of low specific gravity. Its sensitivity is such that it is capable of indicating differences of pressure between two points in the cable as small as 0.00005 lb.

Where the differential pressure meter is to be employed, the first attachment is made in the vicinity of the temporary or permanent valve nearest to the location of the fault, as indicated by the curve of manometer readings. The attachment of this instrument necessitates the perforation of the cable at two points, usually at two adjacent poles. Wherever possible one of the valves already installed on the cable is employed for one of the attachments. After the direction of flow is obtained at the first point of application, readings are taken at intervals, proceeding along the cable in the direction of the gas flow. A change in magnitude or a reversal in the direction of the reading indicates that the fault has been passed. By proceeding back along the cable the individual span in which the leak exists can be determined.

The foregoing discussion has been predicated on the assumption that the majority of the cable being tested is carried aerially. The testing procedure for underground cable is not materially different, except that the readings must, of course, be confined to sections of cable within manholes. As a matter of fact, the testing of underground cables is somewhat simpler in view of the fact that exact location of faults is usually unnecessary. Where

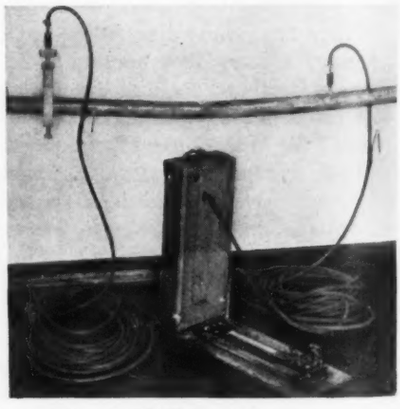

Fig. 6—Differential pressures are measured

the two manholes have been determined between which the fault exists, it is the usual practice to remove the section of cable between them, rather than to undertake repairs of the cable in place by excavating.

Where the differential pressure meter is employed in underground testing the two attachments are made to the cable as near as possible to the points at which the cable enters and leaves the manhole. While differential pressures can in this way be obtained over lengths of cable ranging only from 6 to 8 ft., the sensitivity of the instrument is such that satisfactory indications are in general obtained.

ADVERTISING GIVES SALESMEN—

SEVEN LEAGUE BOOTS

TO outstrip competitors in today's race for sales, let advertising win the attention of the prospect, create the desire to buy, and establish preference for the product. With these things done by advertising, your salesman can start on the actual work of closing the sale.

It's highly questionable whether you *can* meet competition if high-priced flesh-and-blood salesmen do the penny-a-call work that advertising can do as well. Can you afford to make your salesmen devote their time to doing the work which advertising can do at a fraction of the cost?

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WHAT is the OSMOSE PROCESS

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What is this new process for wood preservation that is now receiving the attention of leading utilities throughout the United States?

The OSMOSE PROCESS Is—

- A proved method for arresting and preventing groundline decay in standing poles. . . . NEW only in its application; utilizing wood preservative compounds that have been standard for 20 years.
- A guaranteed economy because it prolongs the use-life of standing poles and materially reduces replacements.
- Simple in its application requiring no capital investment in expensive equipment.
- Effective because the preservative compounds penetrate deeply into the wood.
- NOW BEING USED by many of the country's largest utilities for the preservation of their standing poles.

WRITE FOR THE BOOKLET

giving detailed information concerning the Osmose Process and its application to standing poles and piling. A copy will be sent upon request.

OSMOSE CORPORATION OF AMERICA

BUFFALO, N. Y.

Municipal Items

PARAGOULD, ARK.—Application of the city for a certificate of convenience and necessity to build a municipal power plant and distribution system has been dismissed by the Arkansas State Department of Public Utilities. A hearing was held on the question September 25, when lawyers for the Arkansas Utilities Company, which now is supplying the city with electric service, urged that the petition be dismissed or that action be deferred until after the Arkansas Supreme Court acts upon a case involving the rights of the utilities commission to grant a permit in the case. The utilities company contended that the city had no right to question jurisdiction of the commission, as it did in its application, and at the same time ask the commission to grant a certificate of convenience and necessity. The commission's order of dismissal said the department will not entertain jurisdiction when the applicant denies its right to act in the case and that it will not assume jurisdiction of questions that are pending before the courts of the state. The city plans to build the plant with a P.W.A. loan which will be secured by a bond issue voted by the electors of the city nearly two years ago. The P.W.A. has approved tentatively a loan of $110,000 and a grant of $90,000. The utilities company has a suit pending in the District Court at Washington to restrain Secretary Ickes from granting the city a P.W.A. loan.

LODI, CALIF.—By a vote of 1,306 to 578 the city passed a $466,000 bond issue on September 12 for the erection of a hydro-electric plant on the Mokelumne River for the purpose of supplying energy to the city's municipal distribution system. The bonds will supplement a $130,000 P.W.A. grant, making the total cost of the plant and 270-mile transmission line $596,000. For many years the city has purchased energy wholesale from the Pacific Gas & Electric Company at the average rate of $60,000 annually.

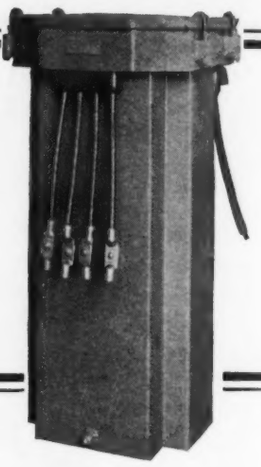
DANVILLE, VA.—By a majority of 423, voters decided on October 1 to build a municipal hydro-electric power plant at The Pinnacles in Patrick County at a total cost of $2,750,000 by supporting the P.W.A. bond issue after a hard and bitterly fought campaign. The vote was 1,953 for the bond issue of $1,513,000, which carries a grant of $1,237,909, and 1,530 against. The favorable vote on the proposed power plant was an absolute reversal of the stand taken by a majority of the voters last year, when by 184 ballots it was decided to decline the government's offer of a $3,000,000 loan.

ST. CHARLES, MO.—City has applied to the P.W.A. for a grant of $29,250 to help finance a proposed municipal light and power plant to cost about $65,000.

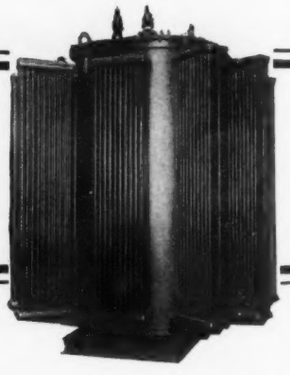
SAN ANTONIO, TEX.—State P.W.A. office at Fort Worth has received the request of the city commission for a loan of $7,000,000 to finance a municipal electric light and power plant and a gas distribution system. A preliminary estimate furnished the city fixed the cost of a gas plant at $5,500,000 and the electric plant at $11,000,000. Forty-five per cent of that cost is approximately $7,000,000, the amount of the city's request for Federal aid. The city has employed engineers to make an appraisal of the San Antonio Public Service Company properties, incident to submission of a proposition of municipal ownership to the voters. That survey will not be completed before the first of next year, but because P.W.A. set a limit on time for receipt of applications, the $7,000,000 request was prepared. The San Antonio Public Service Company, which values its properties at $30,000,000, has announced it is not for sale and will resist installation by the city of competitive lines.

AMERTRAN TRANSFORMERS

For Distribution



And Power



Have you investigated the advantages offered by AmerTran Distribution and Power Transformers? During the recent business depression our engineers have been actively engaged in modernizing our product. Transformers now available incorporate all latest refinements and will satisfy the most exacting requirements. May we send complete information on equipment to meet your specifications?

AMERICAN TRANSFORMER CO.

Transformer builders for over 34 years.

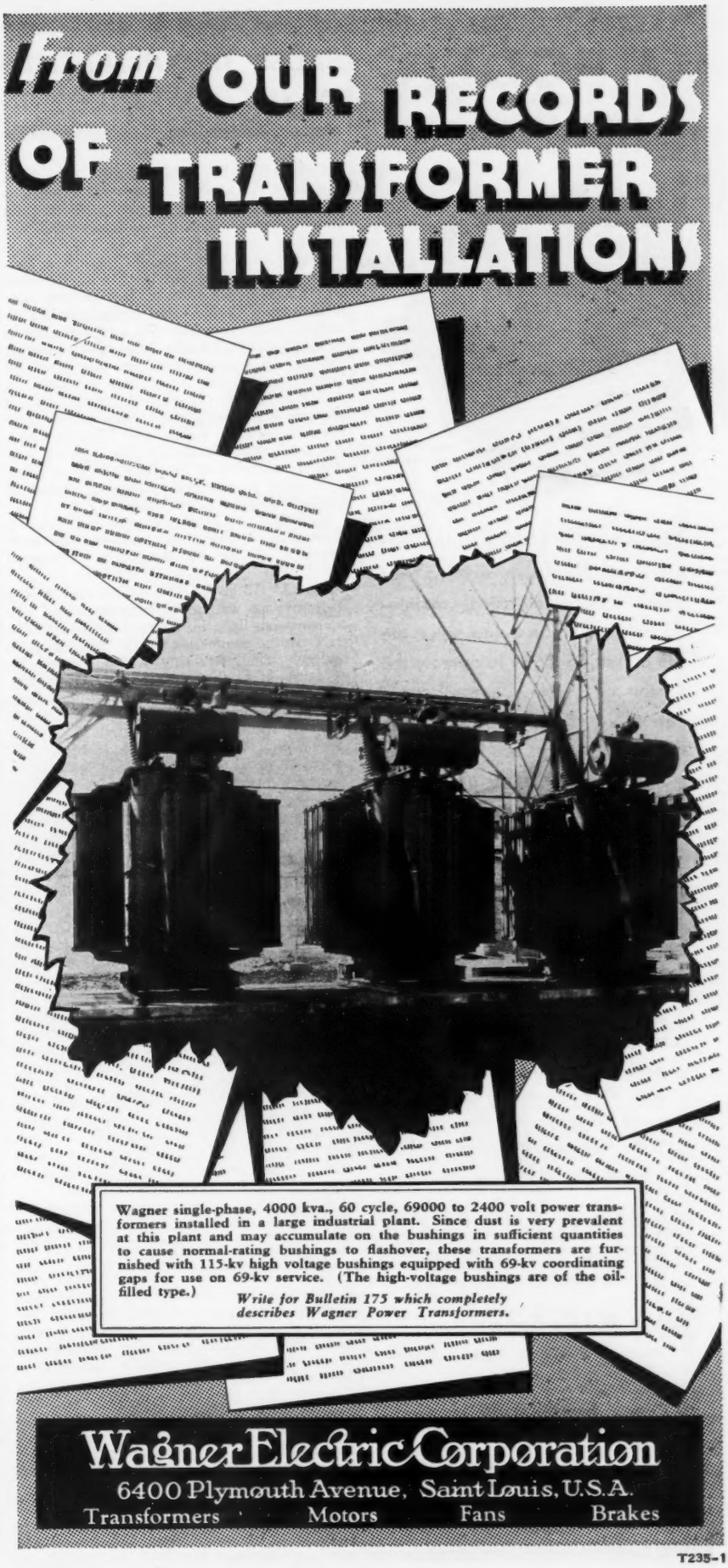
178 EMMET STREET AMER TRAN **NEWARK, N. J., U.S.A.**

BURLINGTON, KAN.—When the U. S. Supreme Court convened in its new ten-million-dollar home this week it found that one of the New Deal cases in which petitions for review had been filed during the recess had been withdrawn by the Kansas Utilities Company, which had asked decision on the validity of the section of the National Industrial Recovery Act by which the P.W.A. is authorized to make loans and grants to municipalities for electric light and power plants. When P.W.A. made a grant of $45,-300 to Burlington, the Kansas Utilities Company challenged the constitutionality of the procedure and lost in the Kansas Supreme Court. No explanation was offered by the company for withdrawal of the request for review, but it was understood it had decided there was a better chance to win in the cases against P.W.A. now being argued in the Court of Appeals for the District of Columbia.

NEBRASKA—P.W.A. has allotted $10,-000,000 to start the huge tri-country power and irrigation project. If carried along the lines of proposed plans the project ultimately would entail expenditures of more than $20,000,000. The project covers an area of approximately 160 miles, from a point near the junction of the North and South Platte Rivers to the east line of Adams County, with perhaps an overflow in Clay County. The estimated cost includes the construction of main canals and diversion dams, two reservoirs and three power plants. State Engineer Tilley has given his approval to both the eastern Nebraska rural public power district and the Lancaster County power district as to the feasibility of their plans for electrification of the area they cover, the eastern district covering nine counties, including Lancaster, and the other covering only rural territory in Lancaster, the city of Lincoln excepted.

CAMDEN, N. J.—Action of Camden voters in ratifying a proposal for construction of a municipally owned electric light and power plant has been overruled by the state Supreme Court. The court held the petition on which the referendum was ordered did not contain the signatures of the required number of qualified voters. The petition and referendum were contested by the Public Service Electric & Gas Company. Counsel for Camden argued that the sanction of the voters at the referendum cured whatever defects there might have been in the petition and that Public Service was tardy in bringing court action. Both contentions were dismissed. City Commission had voted to put the issue before the voters again in November.

BOONVILLE, N. Y.—The Appellate Division of the New York State Supreme Court has been asked to decide whether a municipality making a profit from operation of its own electric light plant may apply the earnings to tax reductions or general funds. The question was raised in connection with the protest by the village of Boonville of a Public Service Commission order reducing rates of its municipal plant $15 000 annually. The commission contended that the plant was making a profit of $10,000 annually and turning it over to the general village fund. The municipality insisted, however, that this was permissible and that the rate reduction would bring a deficit. The state's order was originally made in March, but the operation was suspended by Supreme Court Justice Gilbert V. Schenck pending the outcome of the appeal. Justice Schenck held that taxpayers raised the money to start a municipal plant and are liable for any loss resulting from its operation. "If that be so," he said, "is there any logical reason why, in the event of a profit, such profit should not be used for proper municipal purposes, thereby relieving to some extent the burden of taxation?"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SALES OPPORTUNITIES IN NEW CONSTRUCTION

CHICAGO, ILL.—Commonwealth Edison Company has approved plans for extensions and improvements in power substation on North Western Avenue. Cost over $60,000, including equipment.

DAYTON, OHIO—Bendix Aviation Corporation, 105 West Adams Street, Chicago, Ill., plans installation of motors and controls, conveyors and other equipment in connection with extensions and improvements in former plant of Radio Products Company, Dayton, recently acquired for new precision instrument works. Cost over $200,000.

ROCHESTER, N. Y.—Rochester Gas & Electric Company plans extensions in transmission lines in Wayne and Monroe Counties, with new distribution lines, power substation and service facilities for rural electrification in number of areas. Fund of $200,000 has been authorized.

DENVER, COLO.—Purchasing Agent, Bureau of Reclamation, receives bids until October 18 for 40 floodlights (Proposal A-23125).

KNOXVILLE, TENN.—Tennessee Valley Authority has authorized construction of new transmission lines in Western Tennessee district from connection with Wilson Dam hydroelectric generating station for service at Jackson, Covington, Trenton, Dyersburg, Union City and other communities, from which points a series of secondary lines will be built for rural electrification throughout this area. Project will include about 250 miles of steel tower and wood pole lines, with power substation and service facilities. Cost about $1,000,000.

INDIANAPOLIS, IND.—Chevrolet Commercial Body Division, General Motors Corporation, plans installation of motors and controls, conveyors, electric hoists and other equipment in new one-story plant, 600 x 1100 feet, for commercial automobile body production. New power plant will be built. Cost about $750,000. Albert Kahn, Inc., New Center Building, Detroit, Mich., is architect and engineer.

WAVERLY, IOWA—Plans extensions and improvements in city-owned electric light and power plant, including installation of new Diesel engine units and accessory equipment. Cost about $110,000. Financing is being arranged through federal aid. Howard R. Green Company, 417 First Avenue, S.E., Cedar Rapids, Iowa, is consulting engineer.

MIAMI, FLA.—Florida Power & Light Company, Miami, has authorized construction of new transmission line from Mims to Shiloh, Fla., for commercial service.

PIQUA, OHIO—Plans new transmission line to Troy, Ohio, for light and power service. Cost about $35,000. Financing is being arranged through federal aid.

MEMPHIS, TENN.—Standard Brake Shoe & Foundry, Pine Bluff, Ark., plans installation of motors and controls, electric furnaces, regulators, electric hoists, conveyors and other equipment in new foundry and plant units on site recently acquired at Memphis. Cost about $200,000.

MIDVALE, UTAH—United States Smelting, Refining & Mining Company, 57 William Street, New York, N. Y., will build new addition to concentration mill at smelting plant at Midvale. Cost over $200,000, including equipment.

BOULDER CITY, NEV.—Bureau of Reclamation, Denver, Colo., receives bids until October 18 for quality of line hardware and conductor fittings for 287.5 kv. switchyard

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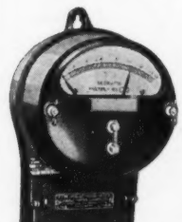

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at Boulder power plant, Boulder Canyon project, Arizona-California-Nevada (Specification 728-D); until October 17 for miscellaneous metal-work, same station (Specification 727-D).

CHARLESTON, S. C.—Plans extensions in airport lighting system in connection with expansion and improvement program at municipal airfield. Entire project will cost $320,000. Financing has been concluded through federal aid.

CARTHAGE, OHIO—Penn-Maryland Corporation, Anthony Wayne Avenue, has approved plans for new two-story addition for bottling works. Cost about $200,000, including equipment. Headquarters are at 120 Broadway, New York.

COVINGTON, ALA. — Covington-Crenshaw-Coffee County Power Association, Covington, recently organized, has secured approval from State Rural Electrification Authority for construction of transmission and distributing lines, with power substations and distribution facilities for rural electrification in parts of Covington, Crenshaw and Coffee Counties, totaling about 145 miles. Cost over $100,000. Financing is under way.

CHICAGO, ILL.—Acme Steel Company, 2840 South Archer Avenue, plans installation of motors and controls, conveyors, electric hoists and other equipment in new one-story addition to mill in Riverdale district. Cost about $125,000.

FULTON, N. Y.—Fulton Silk Mills Corporation plans installation of motors and controls, conveyors, etc., in connection with expansion program for increased output. Company has obtained loan of $100,000 from R.F.C. for project.

LE MARS, IOWA—Plans new city-owned electric light and power plant, and electrical distribution system. Cost about $410,000. Financing arranged through federal aid.

McPHERSON, KAN.—Plans transmission line, with distribution lines and facilities for extensions in present system. Cost $100,000. Financing is being concluded through federal aid. Burns & McDonnell Engineering Company, 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

FELLSMERE, FLA.—Fellsmere Sugar Company plans installation of motors and controls, conveyors, loaders and other equipment in new local cane sugar refining plant. Cost about $125,000.

CHICAGO, ILL.—Wisconsin Steel Company plans installation of heavy-duty motors, controls, regulators, turbo blower, electric hoists and other motor-driven material-handling equipment in connection with expansion and improvements in mills at South Chicago. Cost about $2,000,000. Company is a subsidiary of International Harvester Company, Chicago.

BRYSON CITY, N. C.—Natahala Power Company plans extensions in transmission and distribution lines for rural electrification in several districts. Costs over $60,000.

ANDERSON, IND.—Greer Steel Company, Dover, Ohio, plans installation of heavy-duty motors and controls, regulators, transformer equipment, electric cranes and hoists, and other equipment in new strip steel mill at Anderson. Cost $400,000.

YANKTON, S. D.—Plans city-owned electric light and power plant, and electrical distribution system. Cost about $600,000. Financing is being arranged through federal aid. Buell & Winter Engineering Company, Insurance Exchange Building, Sioux City, Iowa, is consulting engineer.

DEARBORN, MICH.—American Blower Corporation, 6000 Russell Street, Detroit, Mich., plans installation of motors and controls, conveyors, electric hoists and other equipment in new one-story branch plant at Dearborn, 120 x 440 ft. Cost about $250,000. Albert Kahn, Inc., New Center Building, Detroit, is architect and engineer.

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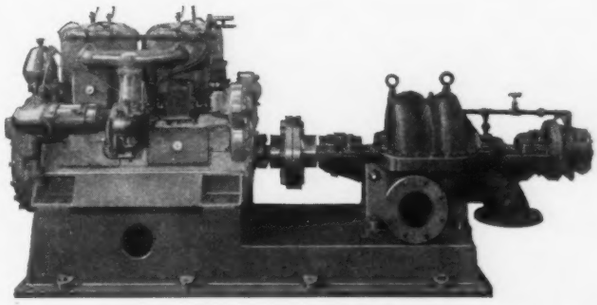

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